OPERATING INSTRUCTIONS

ZIRKOR200

Oxygen analyzer

Installation, operation, maintenance

SICK
Sensor Intelligence.

Notes concerning this Manual

This manual contains important information about the design, installation, commissioning, operation, maintenance and troubleshooting. Safe work with the ZIRKOR200 requires the users to become familiar with all warnings, safety instructions and maintenance aspects of this manual.

Symbols used in this Manual

All symbols listed beneath, attached to the analyzer or noted in this manual show important information as well as safety instructions for installation, operation and maintenance, to protect the personnel and the equipment.

	**Warning** Follow all instructions of this manual
	**Warning hot Surface** Warns of danger of burns which could occur from hot system parts
	**Caution** Warns of risks of destroying the system or its components or its functionality

	**Consider Information** Points out important information which must be considered before execution
	**Note** Contains further detailed information
	Ground earth electrical protection

Safety Instructions

The ZIRKOR200 System is operated with line voltage. After removal of terminal covers some parts of this system may be accessible which are under high line voltage.

Only well trained and authorized personnel are allowed to work on this system. The personnel must know and understand all precautions, safety instructions, installation and maintenance instructions of this manual. The trouble free and safe operation of the ZIRKOR200 requires safe transportation, professional storage, installation, operation and maintenance.

Furthermore all local safety requirements at the point of installation and operation must be considered.

ZIRKOR200 may not be used to measure oxygen in combustible gases or in an environment with combustible gases. Parts of this system may cause an explosion risk.

Manufacturer

SICK AG
Erwin-Sick-Str. 1 · 79183 Waldkirch · Deutschland
Telefon: +49 7641 469-0
Fax: +49 7641 469-1149
E-Mail: info.pa@sick.de

Table of Contents

1 System Description 4

1.1 System Overview 4
1.2 Measuring Principle 6
1.3 Intended use 6
1.4 Safety Hazards 6
1.5 Disruption of the Process....6
1.6 Storage instructions 6
1.7 Name Plates 7

2 Installation 8

2.1 Installation Requirements for Electronic Unit 8
2.2 Installation of Probe Signal Cable 9
2.3 Access to the Terminals 10
2.4 Ferrite Sleeves (EMC) 10
2.5 Wiring Diagram of the Electronic Unit....11
2.6 ZIRKOR200 Wiring diagram 12
2.7 Installation of the probe 13
2.8 Mounting of the Probe 13
2.9 Mounting a probe with Cooling Protection Tube 14
2.10 Adjusting the V-Shield 14
2.11 Electrical Connections of the Probe 15
2.12 Requirements for the Pneumatic Tube....15
2.13 Preparation of the pneumatic Tube 16
2.14 Gas plans....16
2.15 Pneumatic Connections of the Probe....17
2.16 Pneumatic Connections of Electronic Units 17

3 Initial Operation 19

3.1 Checklist before commissioning the system 19
3.2 System Power Up 19
3.3 Display - Probe Heating Phase 19
3.4 Display - Measuring Mode 20
3.5 Keypad and Display....20
3.6 Status LEDs 20
3.7 Soft key Symbols 20
3.8 System Code 20

4 Software Overview and Explanations 21

4.1 Menu Overview - SYS-MENU....21
4.2 Software Explanations - SYS-MENU....24
4.2.1 O_2 Measuring Ranges (Scaling) 24
4.2.2 Measuring value averaging for 24
4.2.3 mA output on system errors....24
4.2.4 O_2 limit alarm settings....24
4.2.5 O_2 Sensor calibration values 25
4.2.6 Time per test gas apply 25
4.2.7 Delay time to process 25
4.2.8 Automatic Calibration (ACAL)....25
4.2.9 Automatic Calibration Settings 25
4.2.10 REMOTE....26
4.2.11 Measuring units 26
4.2.12 Language....26
4.2.13 Change system code....26
4.2.14 Load factory settings....26
4.2.15 Service (Factory Service Settings) 26
4.3 Calibration Menu....27
4.3.1 Calibration Menu - Display Overview 27
4.3.2 1-point calibration (manual)....28
4.3.3 2-point calibration (manual)....28
4.4 System Checks 29

5 Service and Maintenance 30

5.1 Exchange fuses....30
5.2 Flow rates for Test Air and Reference Air....31
5.3 Adjusting Flow Rate (integrated Pneumatics)....31
5.4 Position of the adjustment valves 32
5.5 Adjusting Flow Rate (19” 4HE) 32
5.6 Replacing the probe 33
5.7 Replacing the O_2 Sensor....33
5.8 Exchange of Probe Inner Parts....35
5.9 Relay Outputs / Functions and Correlation....36
5.10 Digital Inputs....37
5.11 Stability Criteria for Calibration 37
5.12 Reaction Time of the mA Output....37
5.13 Extension Modules....37
5.14 Maintenance Intervals....37

6 Status Messages 38

6.1 Error Messages....38
6.2 Alarm Messages 39
6.3 Maintenance Messages 39

7 Troubleshooting 40

A Technical Data 41

A.1 Technical Specifications - Electronic Unit....41
A.2 Technical Specifications - Probe....42
A.3 Gas Supply - Systems with Instrument Air....43

B Dimensional drawings 44

B.1 Dimensions of Electronic Unit Housing versions ... 44
B.2 Probe Dimensions....45
B.3 Counter Flange Dimensions....48
B.4 Dimensions of protection tube flanges....49

C Spare Parts 50

C.1 Probe Components Probe lengths 1 - 2....50
C.2 Probe Components Probe lengths 3 - 5....51
C.3 Mounting Plates of the Electronic Unit....52
C.4 Display Board....53

Index 54

1 System Description

1.1 System Overview

	Info Depending on the system configuration ordered by the customer, the electronic unit and / or probe may vary. Refer to chapters **B** and **B.2** for different versions of electronic units and probes.

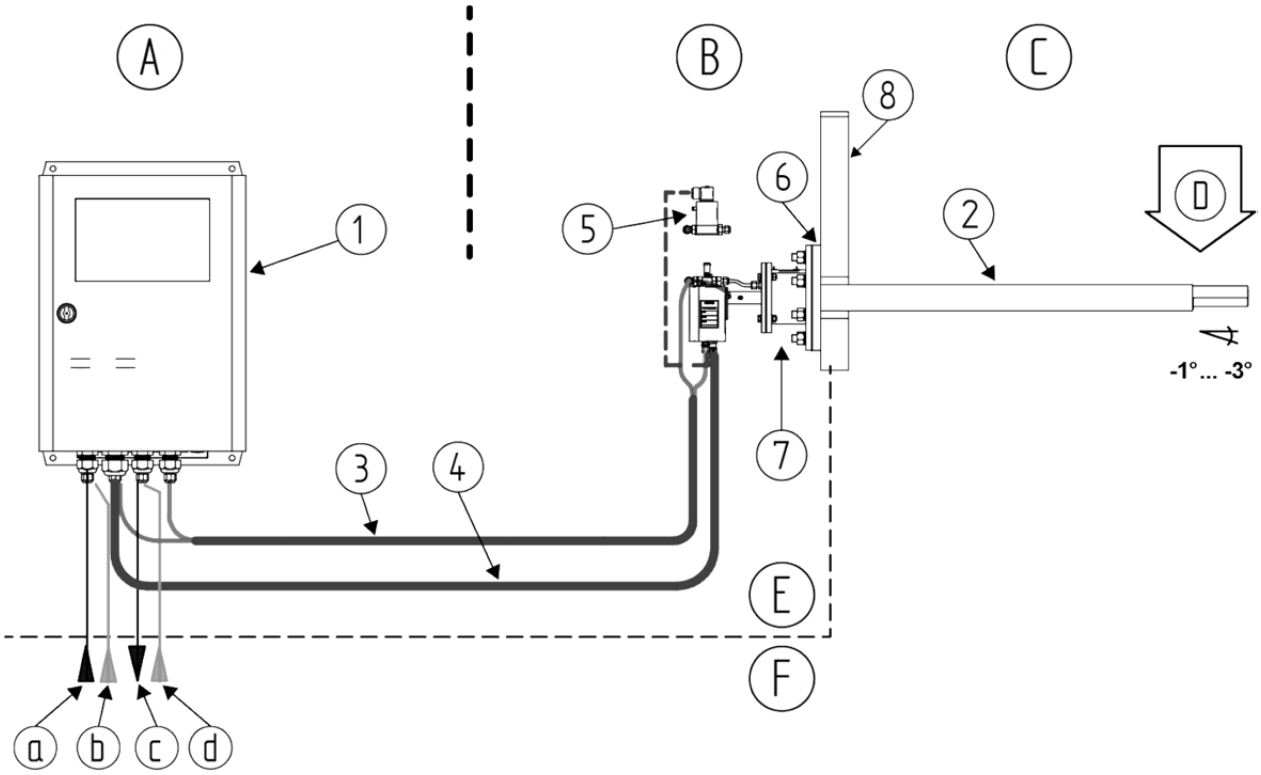


Figure 1 - ZIRKOR200 (probe without cooling tube for flue gas temperatures of up to 600°C)

1	Electronic unit SME5 / IP66
2	In-situ measuring probe / IP65
3	Pneumatic cable
4	O_2 probe signal cable
5	Solenoid valve (Optional)
6	Counter flange (Optional)
7	Isolation: Customer
8	Duct wall

A	Safe Area - Max. ambient temp.:-20°C to +55°C (-4°F to + 131°F)
B	Safe Area - Max. ambient temp.:-20°C to +80°C (-4°F to + 167°F)
C	Duct / combustion chamber
D	Flue gas direction – max. flue gas temperature 600 °C
E	Manufacturer supply
F	Customer supply
a	Power supply
b	Test gas in
c	Output signals (analog and digital)
d	Instrument air in

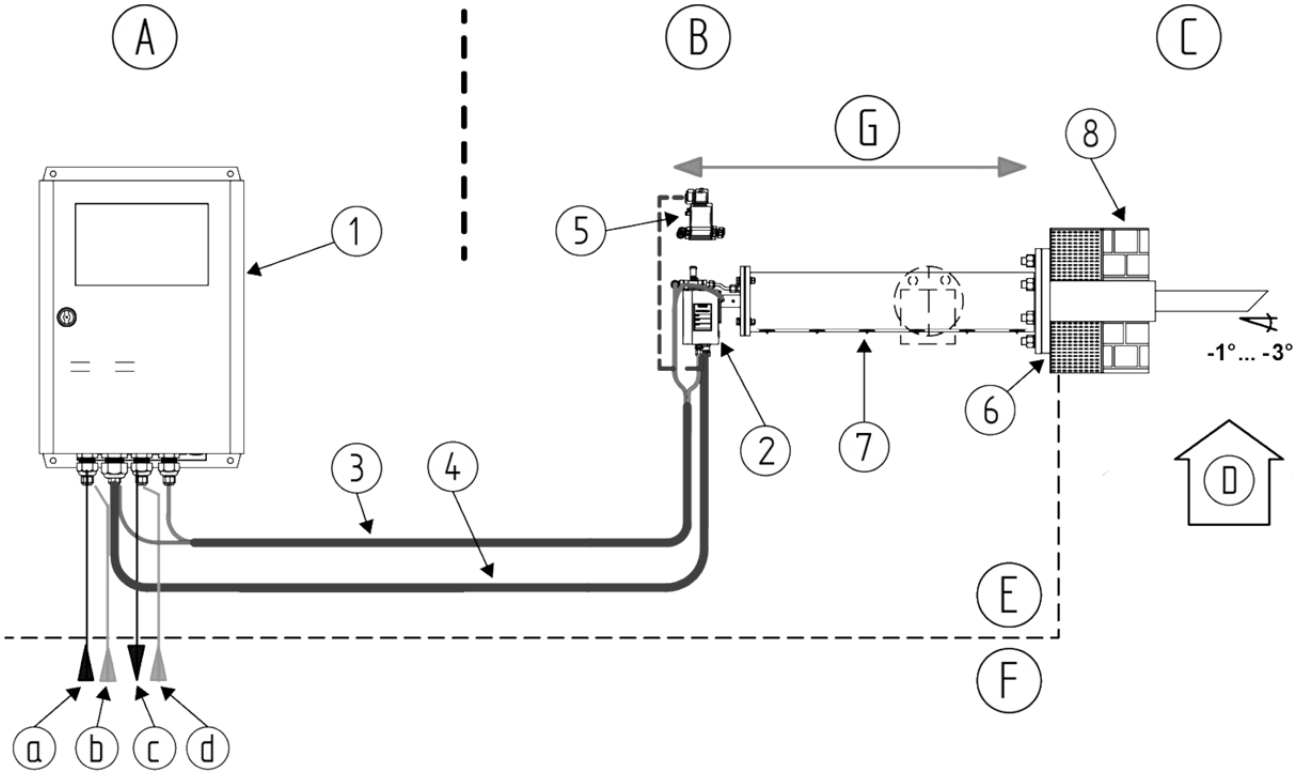


Figure 2 – ZIRKOR200 (probe with cooling tube for flue gas temperatures of up to 1600°C)

1	Electronic unit SME5 / IP66
2	In-situ measuring probe / IP65
3	Pneumatic cable
4	O_2 probe signal cable
5	Solenoid valve (Optional)
6	Counter flange (Optional)
7	Isolation: Customer
8	Duct wall

A	Safe Area - Max. ambient temp.:-20°C to +55°C (-4°F to + 131°F)
B	Safe Area - Max. ambient temp.:-20°C to +80°C (-4°F to + 167°F)
C	Duct / combustion chamber
D	Flue gas direction – max. flue gas temperature 1600 °C
E	Customer supply
F	Manufacturer supply
G	Space required: 2.0m for standard installation. 0,8m for 90°elbow construction
a	Power supply
b	Test gas in
c	Output signals (analog and digital)
d	Instrument air in

1.2 Measuring Principle

The ZIRKOR200 O_2 analyzer system consists of an in-situ probe which is installed in a duct to measure non-combustible process gases and of an electronic unit for voltage and gas supply, as well as for signal processing.

The oxygen sensor is at the tip of the probe and is regulated to 800 °C and works on the zirconium oxide principle of measurement. Here, a mV signal between the reference gas side of the sensor (inside, instrument air 20.95% O_2) and the measured gas side is measured, which depends logarithmically on the ratio of oxygen partial pressures on both sides of the sensor.

The mV signal is converted according to the Nernst equation into oxygen partial pressure within the process gas, whereby the O_2 concentration is determined in the process gas. Gas-tight separation of reference air and process gas is of particular importance.

Should combustible components such as CO or H_2 be present in the sample gas, they will react with oxygen at the sensor surface and can reduce the measured value.

1.3 Intended use

Info

The ZIRKOR200 analyzer system is a system for measuring the oxygen concentration in flue gases and other non-combustible gases. For reasons of safety and the possibility of accidents, unauthorized conversions and modifications of the system are prohibited.

Warning

The system cannot be used to determine the oxygen concentration of combustible gases or in a location where combustible gases are present as the measuring cell temperature of 800°C could present an explosion hazard!

Info

The minimum concentration of O_2 in flue gas should under normal process conditions, not be less than 0,5%.
If the O_2 concentration is regularly below 0,5%, we recommend the option of **LL² (Long Life²)** to protect the O_2 sensor.

Caution

Under no circumstance should the measuring probe be directly connected to the 230V main power supply, as this will immediately destroy the probe heater element!

1.4 Safety Hazards

Warning hot surface

During operation, the temperature of the probe filter head and of other parts exposed to flue gas is 150°C - 800°C (302°F - 1472°F). Direct contact with the hot parts when dismantling or maintenance will cause severe burns!

The probe may only be removed with heat-insulated gloves. Before removing the probe, always switch off the supply voltage of the electronic system. After removal, store the probe in a safe, protected place and wait until it has cooled down below 35°C (95°F).

1.5 Disruption of the Process

The analyzer system has to be kept in operation also in the event of the process being disrupted or if the plant is powered off temporarily (e.g. at night or during the weekend). Frequently cooling down and heating up of the probe results in thermal stress of the hot probe parts (heater, thermocouple and sensor) and reduces their product life. Responsibility will not be accepted for resultant damage.

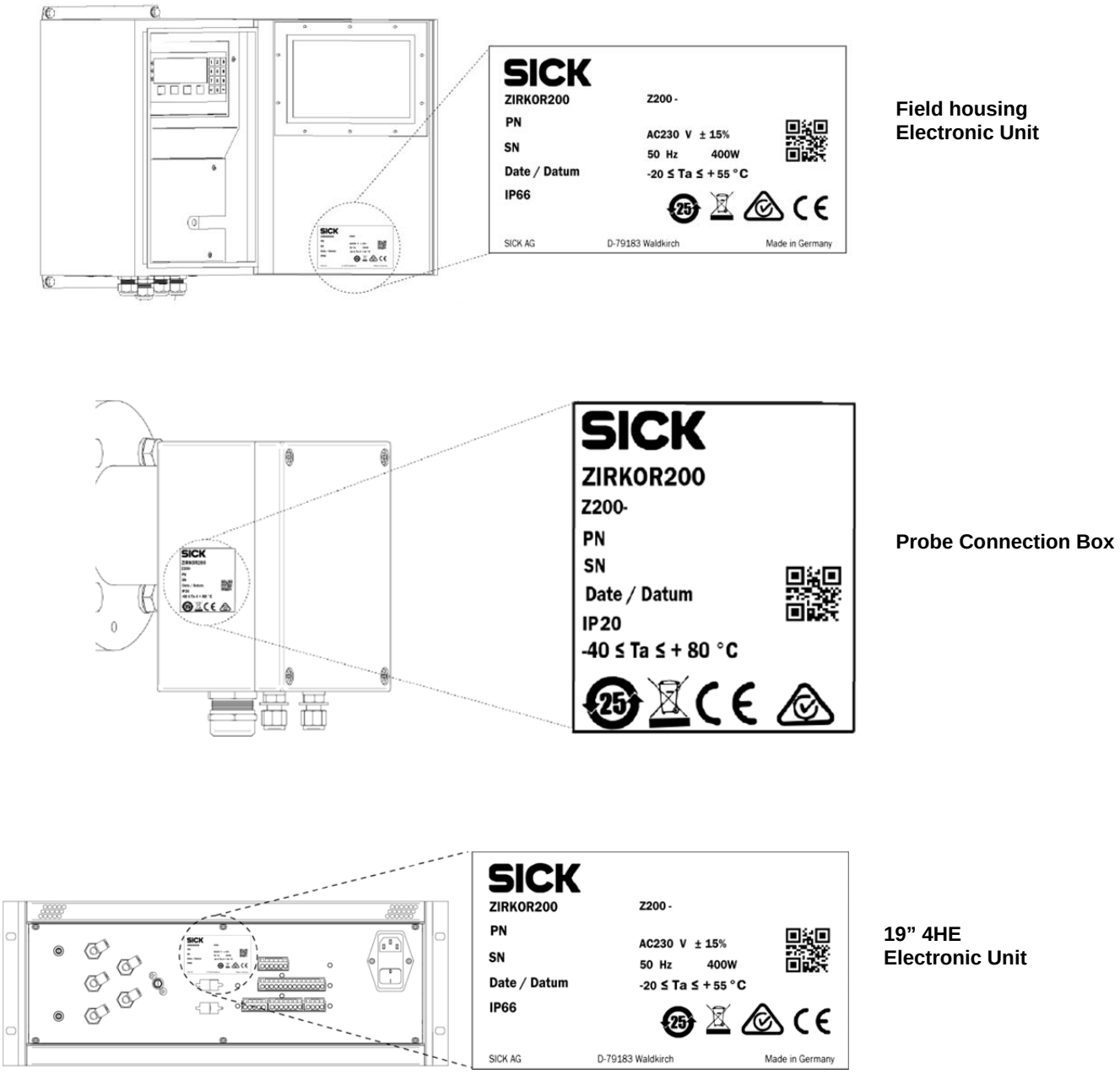
1.6 Storage instructions

All equipment and spares are to be stored in a dry and ventilated environment. Paint fumes, silicone sprays, etc. must be avoided in the storage environment.

1.7 Name Plates

The name plate contains information about the line voltage, the nominated current, frequency, protection class, year of manufacture, serial number, and system order code.

The system order code refers to information which is detailed in the system test report and supplied with the system.



Field housing Electronic Unit

Probe Connection Box

19” 4HE Electronic Unit

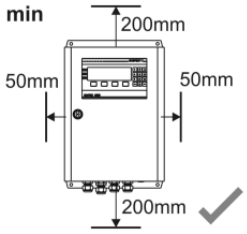
Figure 3 - Position of the name plates

2 Installation

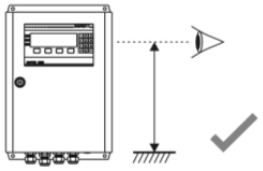
Warning

The device must be provided with an external power-off switch. The line voltage switch/fuse/breaker must be in accordance with the local technical standards and should be near to the electronic unit and must be clearly marked as such. The probe cable is suitable for an ambient temperature range from -40°C to +90°C. All other installed cables must be suitable for the ambient temperature range at side and must have the required size. All electronic unit terminals are specified from 0,08mm² (AWG 26) to 2,5mm² (AWG 14). If wire end ferrules are used the next smaller size is required. Before removal of the electronic terminal (Figure 5) cover the line voltage must be switched off. The line voltage to the electronic unit must be switched on again after the cover is back in position. After installation power conducting parts may not be accessible.

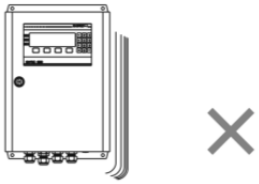
2.1 Installation Requirements for Electronic Unit



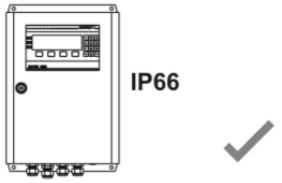
Keep the minimum distance to adjacent objects



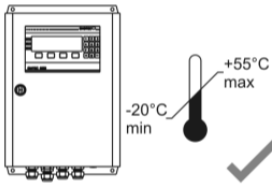
Install at eye level



Avoid vibrations greater than 2g



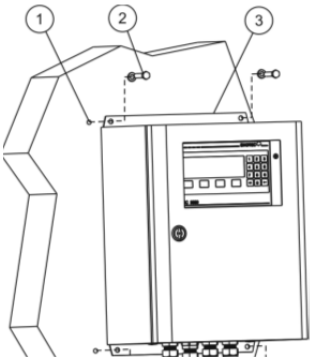
Mind the IP code



Heavy equipment, ensure proper lifting and carrying

Ambient temperatures

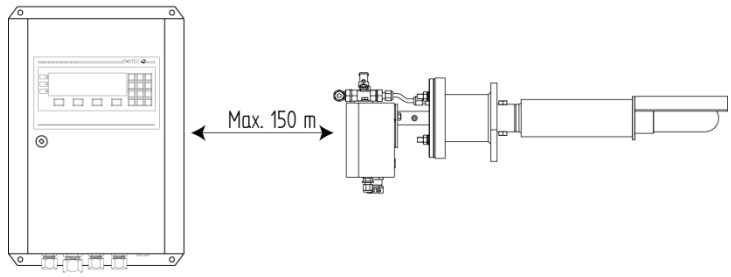
Min.: -20 °C (-4 °F) / Max.: +55 °C (+131 °F) - (Pump version -20°C to +50°C)



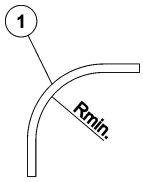
1	Drill holes for the electronic unit
2	Use suitable screws
3	Electronic unit

Figure 4 - Installation of the Electronic unit

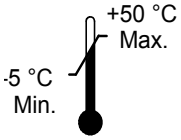
2.2 Installation of Probe Signal Cable



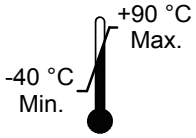
Abide by the maximum cable length (max. 150m)



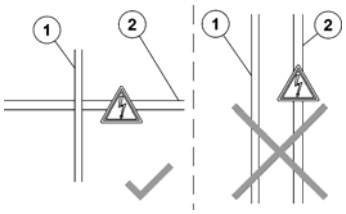
Note the minimum bending radius.
R_{min} = 96 mm



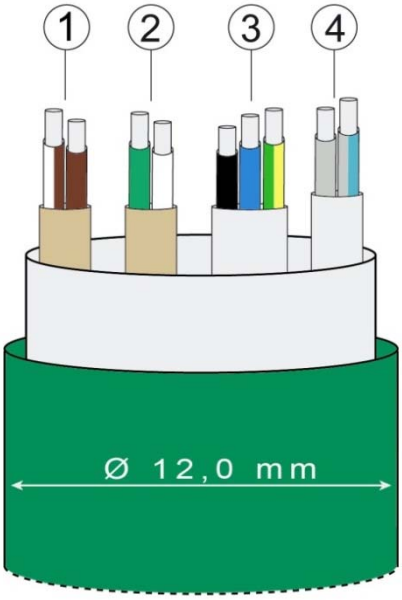
Temp. during installation



Temp. during operation



Cross the probe signal cable (1) at right angle to power supply cables (2)



Probe Cable				
No.	**Function**	**Diameter**	**Colors**	**Additional info.**
(1)	Measuring cell	2 x 0,75 mm^2	white-brown / brown	With shield
(2)	Thermocouple	2 x 0,75 mm^2	green / white	With shield
(3)	Probe heating	3 x 1,5 mm^2	black / blue / green-yellow	
(4)	Solenoid valve	2 x 0,75 mm^2	grey / grey-blue	

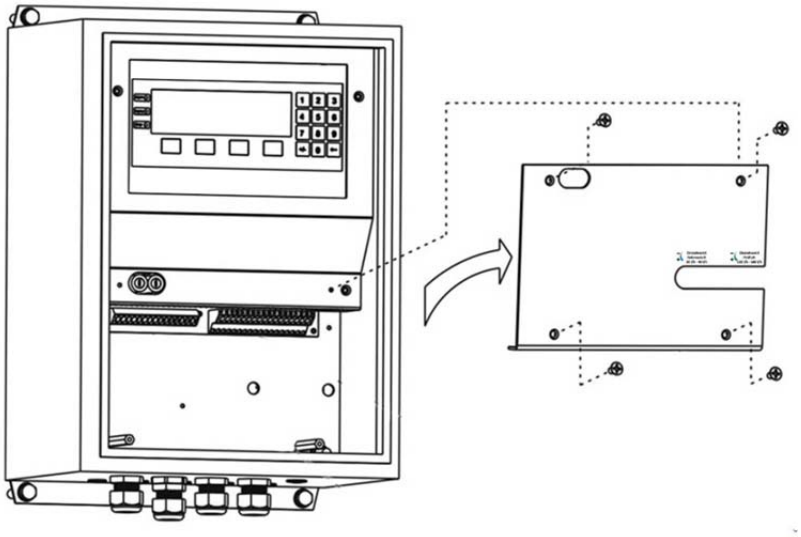
Figure 5 - Probe signal cable

Caution

Probe cables must be treated as measurement cables. Do not connect the shield of the probe cable probe.

2.3 Access to the Terminals

⚠	**Warning** Before removing the terminal covers, switch off the mains voltage to the system. Switch the mains voltage on only after attaching the terminal cover. After the installation has been completed, live parts may no longer be accessible.



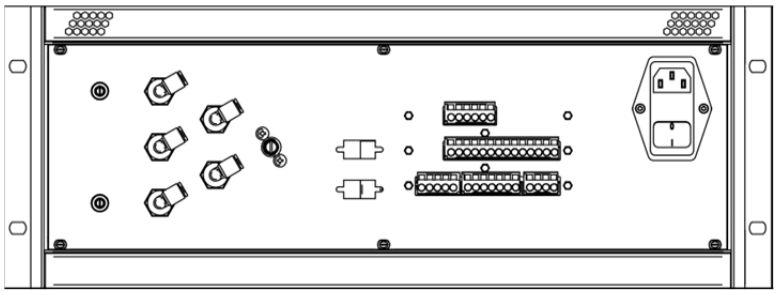


Figure 6 - Access to the Terminals (field housing and 19” 4HE electronic units)

2.4 Ferrite Sleeves (EMC)

!	**Caution** In order to avoid cable related disturbances to the electronic unit, the supplied ferrite sleeves must be used. **CE-conformity is invalid if these ferrite sleeves are not fitted!**

2.5 Wiring Diagram of the Electronic Unit

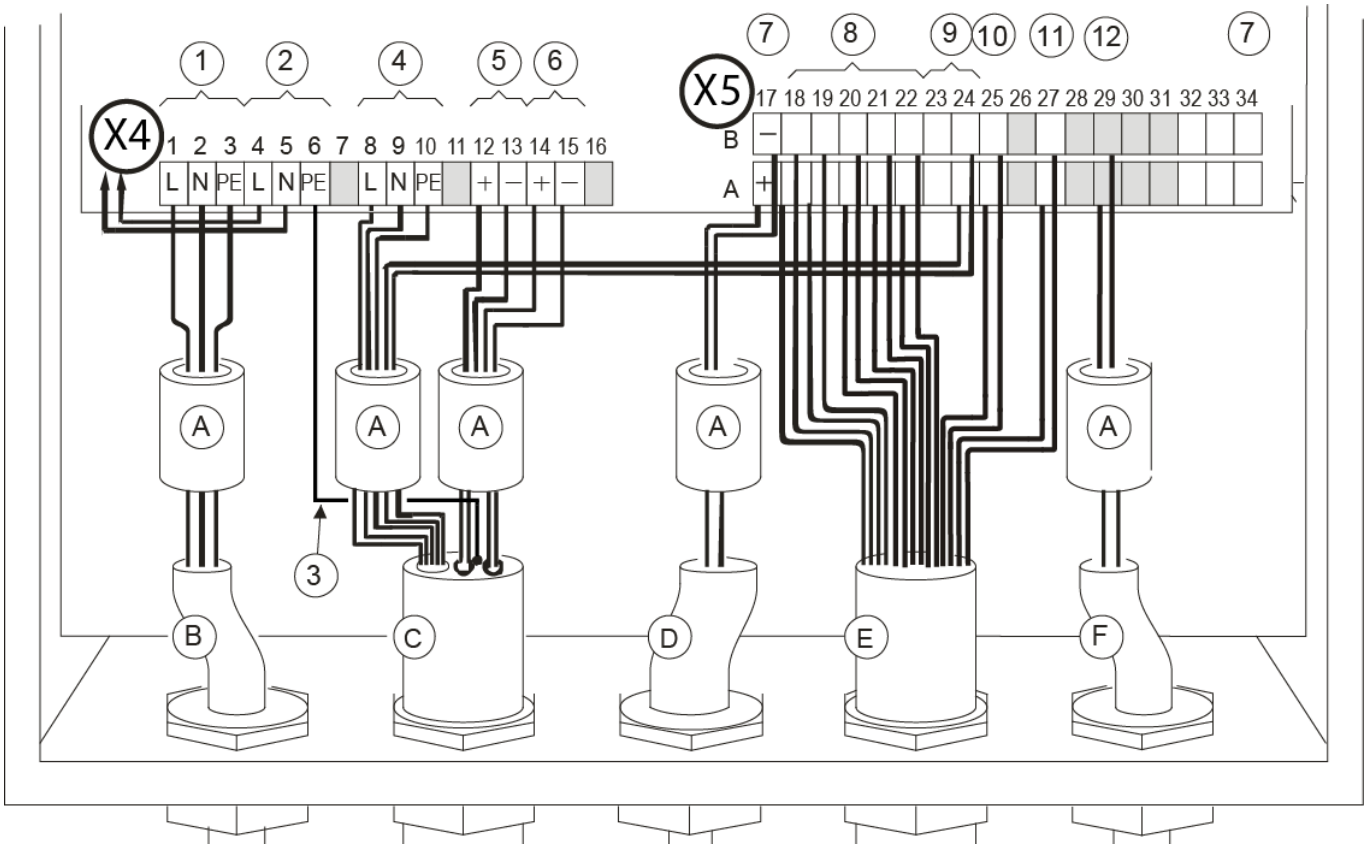


Figure 7- Wiring diagram of the Electronic Unit

(A) Ferrite sleeves (Enclosed)

(B) Power supply cable (customer)

(C) Probe signal cable

(1) **Power supply (115/230V AC, 50/60Hz)**

1	L	phase
2	N	neutral wire
3	PE	grounding conductor

(2) **Internal Power supply** [1]

4	L	phase
5	N	neutral wire
6	PE	grounding conductor

(3) **Shielding**

(4) **Internal Power supply probe heater 115V AV**

8	L_H	black
9	N_H	blue
10	PE	green/yellow

(5) **O_2 sensor signal**

12	+	brown
13	-	brown/white

(6) **Thermocouple (O_2 sensor)**

14	+	green
15	-	white

(7) **Analogue outputs (active 4-20mA)**

17A	+	O_2
17B	-	O_2

(D) Analogue output cable (customer)

(E) Status signal cable (customer)

(F) Pressure transmitter analogue input cable (option , customer)

(8) **Relay contacts for status signals - Potential free**

18 A/B	Maintenance
19 A/B	System Error
20 A/B	Output A O_2 measuring range
21 A/B	O_2 Limit Alarm 1
22 A/B	O_2 Limit Alarm 2

(9) **Probe solenoid valve**

23 A 23 B	Internal Power supply for probe solenoid valve	
24A	L_V	grey
24B	N_V	grey/blue

(10) **Measuring Range O_2 (12..24V DC- External supply)**

25A	+
25B	-

(11) **Calibration release (12..24V DC - External supply)**

27A	+
27B	-

(12) **Input Process pressure (passive 4-20mA)**

29A	+
29B	-

[1] The output voltage of these contacts (4…6) always have the same voltage as on the power supply input on contacts (1…3)

2.6 ZIRKOR200 Wiring diagram

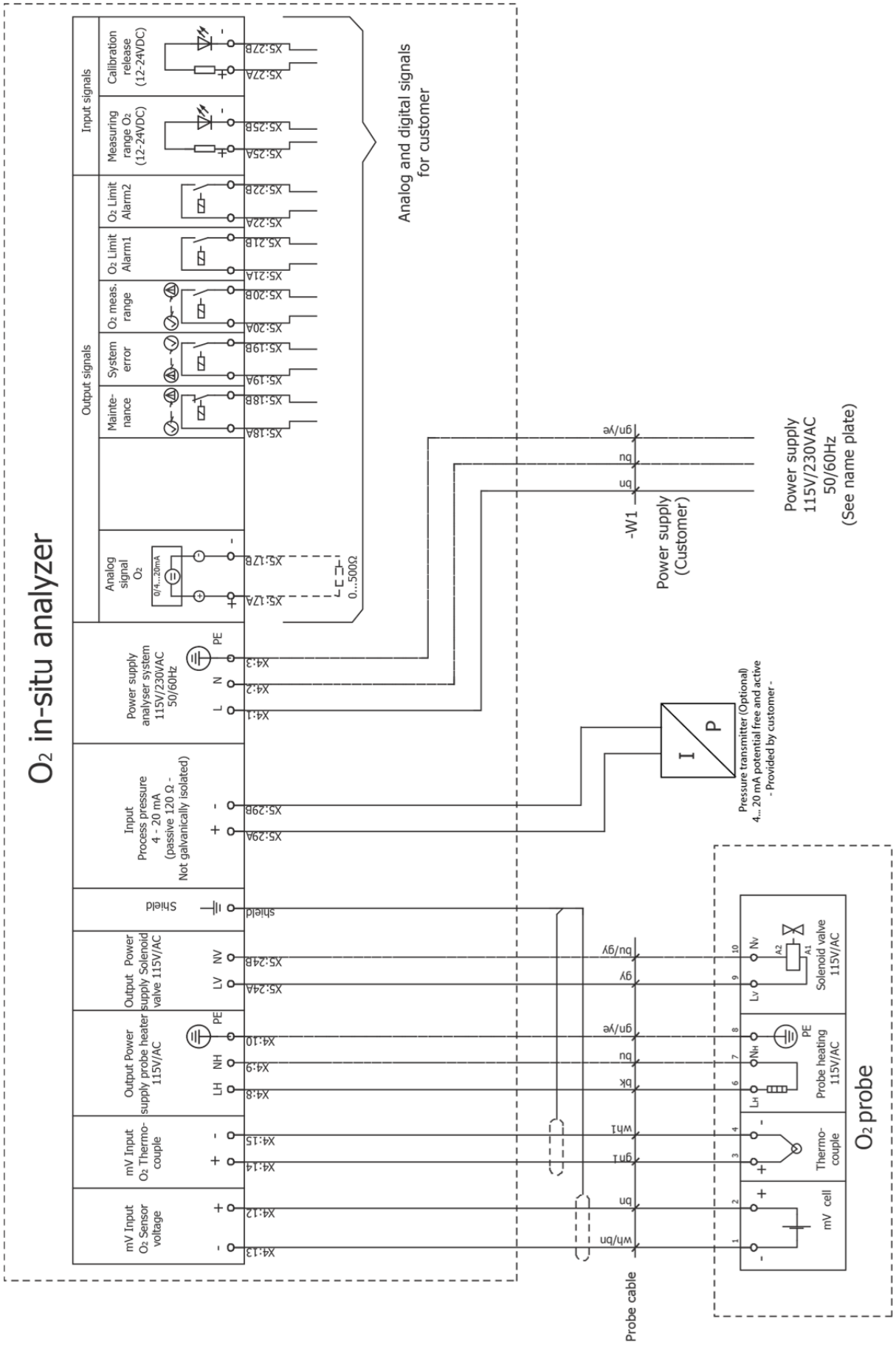
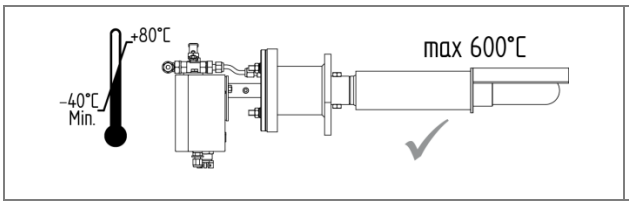


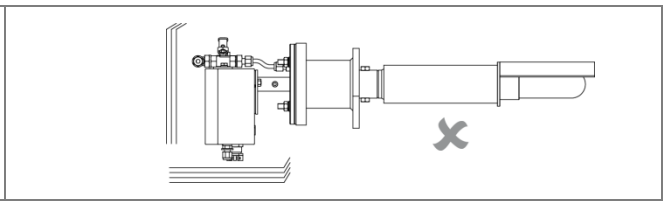
Figure 8 - Wiring diagram of the ZIRKOR200 analyzer system

2.7 Installation of the probe

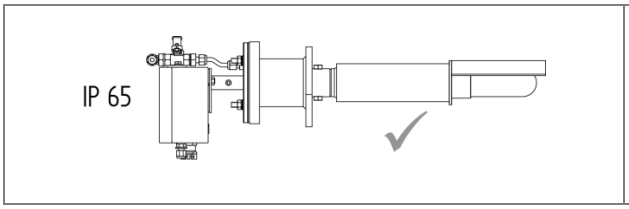
The flue gas temperature, pressure and all other process conditions must be in accordance with the specification (see chapter A.2). Leave enough space for insertion/removal of the probe and protection tube (if supplied) and ensure access to the measuring probe and/or connecting box. Before cutting a hole in the flue gas duct, make sure that the inside of the duct has enough space for probe installation and that no soot is blown out nearby or any obstacles are in the way. For probe lengths exceeding 2000 mm, a support must be mounted inside the duct (every 2m) to prevent the probe and mounting tube from flexing or bending. It is recommended to install the probe horizontally for the fastest possible response time.



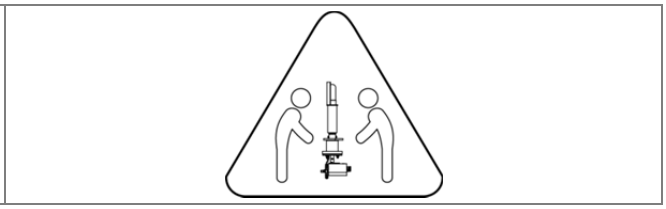
The ambient temperature at the connection box and the process temperature must not be exceeded.



Avoid vibrations greater 2g



Maintain the protection class



Heavy equipment, ensure proper lifting and carrying

2.8 Mounting of the Probe

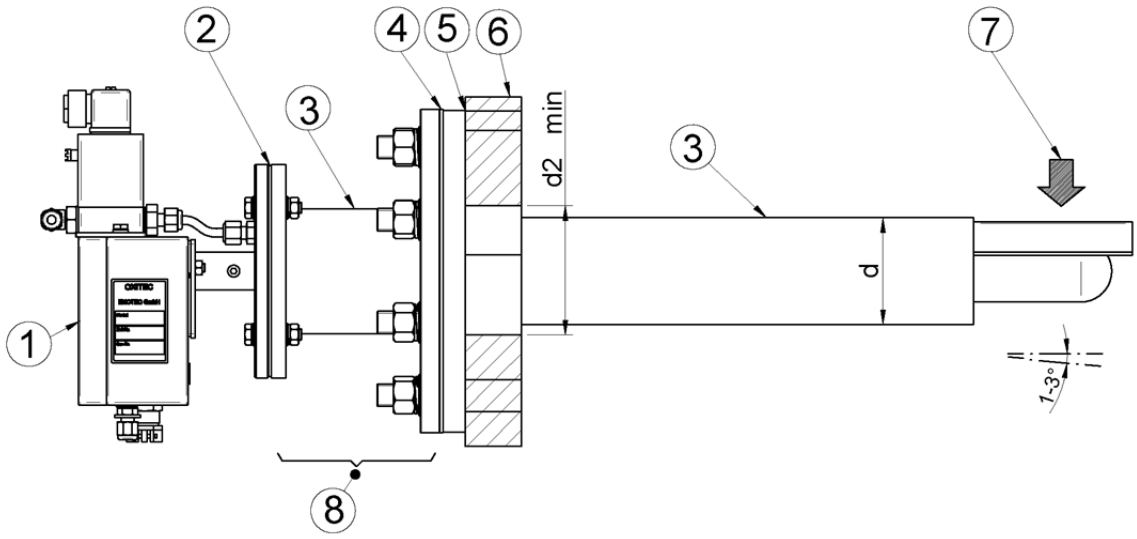


Figure 9 - Mounting of the O_2 probe – for dimensions, see **section B.**

①	Probe connection box
②	Flange gasket
③	Protection tube
④	Flange gasket

⑤	Counter flange which has been welded gas tight at correct angle to duct
⑥	Duct wall
⑦	Flue gas direction
⑧	Insulate here to avoid dew point condensation

2.9 Mounting a probe with Cooling Protection Tube

	Info If a cooling tube is used, the part of the protection tube projecting from the duct wall must be insulated or heated if necessary, to prevent its temperature from dropping below the dew point. **Make sure that the gas outlet is not blocked.**

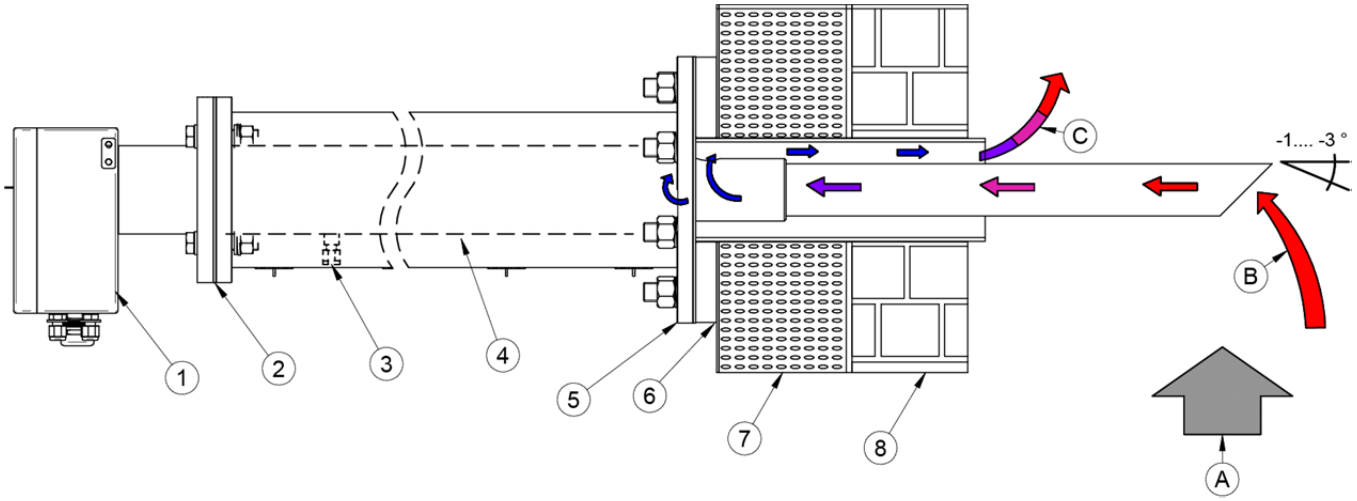


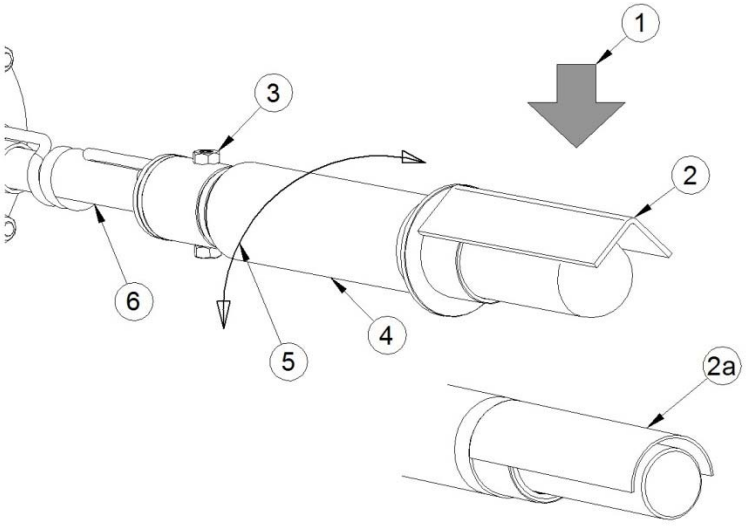
Figure 10 – Mounting and insulation of the cooling protection tube

1	Probe connection box
2	Flange gasket
3	Suction connection
4	Cooling tube - Insulate to avoid condensation
5	Protection tube flange
6	Counter flange welded gas tight at correct angle

7	Steel cover
8	Duct wall
A	Flue gas
B	Gas entry
C	Gas outlet – do not block

2.10 Adjusting the V-Shield

Before installing the probe, **the direction of flue gas flow must be determined** and the filter head assembly turned to such a position that the V-shield faces the oncoming flue gas. The filter head can be turned freely a full 360° for this purpose, by loosening the counter nut, loosening the Allen screw and rotating the filter head / V-shield to the required position, and then tightening the Allen screw and counter nut.

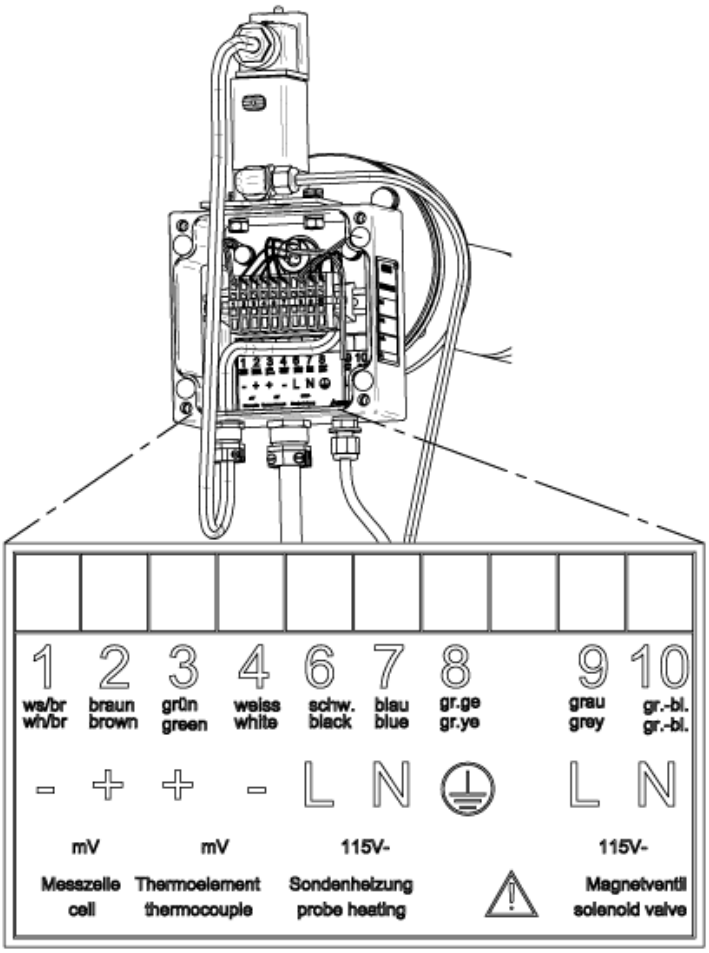


1	Flue gas direction
2	V-shield (Z200)
2a	V-shield (alt.)
3	Screws to secure filter head
4	Filter head
5	Rotation of filter head
6	Probe

Figure 11- Adjustment of the V-shield

2.11 Electrical Connections of the Probe

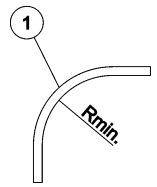
Info
The probe cable has to be connected to the terminal board in the probe terminal box.
Do not connect the shield of the probe cable probe.



1 : - mV O_2 sensor (white-brown)
2 : + mV O_2 sensor (brown)
3 : + mV thermocouple 1 (green)
4 : - mV thermocouple 1 (white)
6 : L 115VAC heater (black)
7 : N 115VAC heater (blue)
8 : PE Protection earth (green yellow)
9 : L 115VAC solenoid valve (grey)
10: N115VAC solenoid valve (grey-blue)

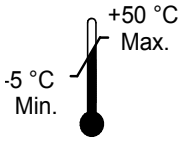
Figure 12 - Electrical Connections of the probe connection box

2.12 Requirements for the Pneumatic Tube

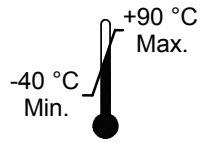


Note the minimum bending radius.

R_{min} = 138 mm

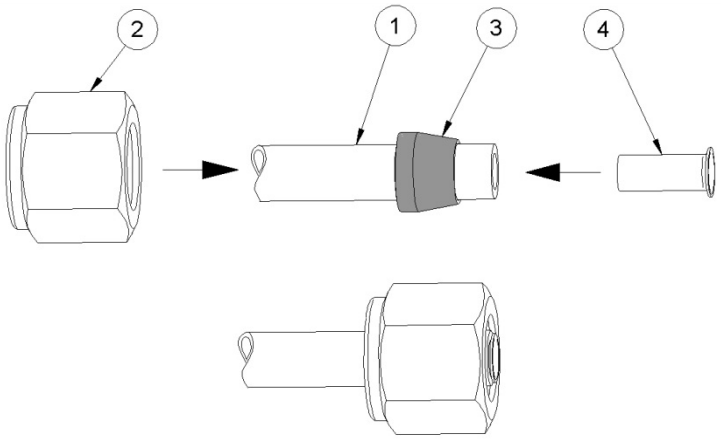


Temp. during installation



Temp. during operation

2.13 Preparation of the pneumatic Tube



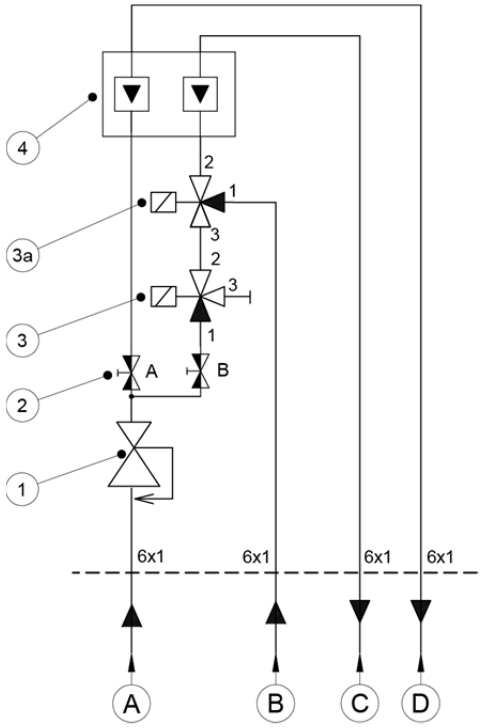
1	Pneumatic tubing
2	Nut
3	Clamp ring
4	Support sleeve

Both, the pneumatic tubing for the reference air (blue) and the test gas (green) have to be prepared with support sleeves 4, clamp rings 3 and nuts 2.

Figure 13 - Preparation of pneumatic tubes

2.14 Gas plans

Pneumatic version for Instrument air



Pneumatic version with pumps

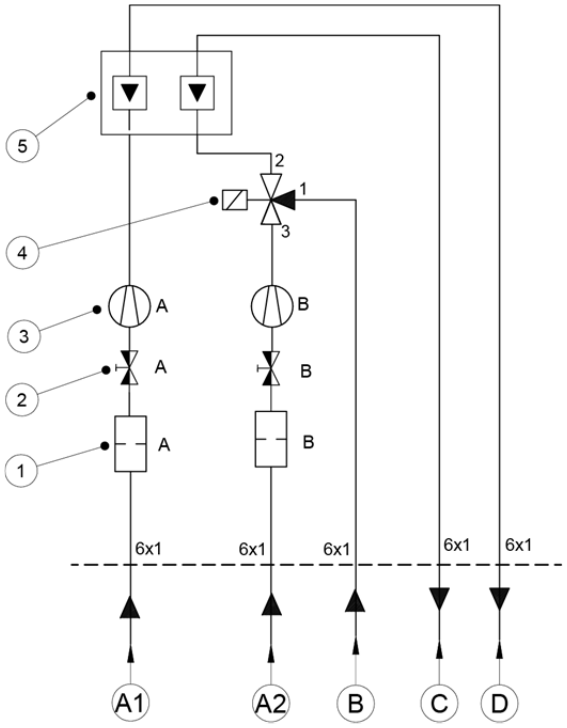
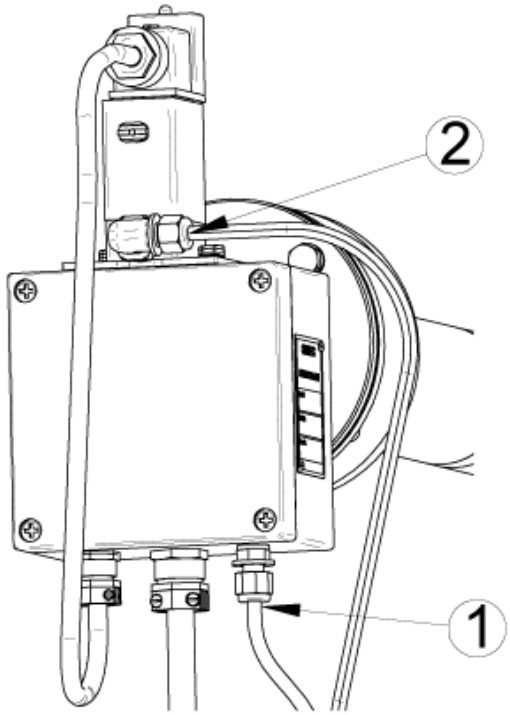


Figure 14 - Gas plans

1	Pressure control valve
2	Choke non return valve
3	Solenoid valve 3/2 ways
3a	Solenoid valve 3/2 ways
4	Flow meter
A	Test gas in
B	Test gas out
C	Instrument air in
D	Reference air out

1	Filter
2	Choke non return valve
3	Reference air pump / Test air pump
4	Solenoid valve 3/2 ways
5	Flow meter
A1	Test gas in
A2	Test gas out
B	Reference air in
C	Reference air out
D	Test air in

2.15 Pneumatic Connections of the Probe



①	**Reference air** in: blue tube
②	**Test gas** in: green tube

Figure 15 - Pneumatic connections of the probe

2.16 Pneumatic Connections of Electronic Units

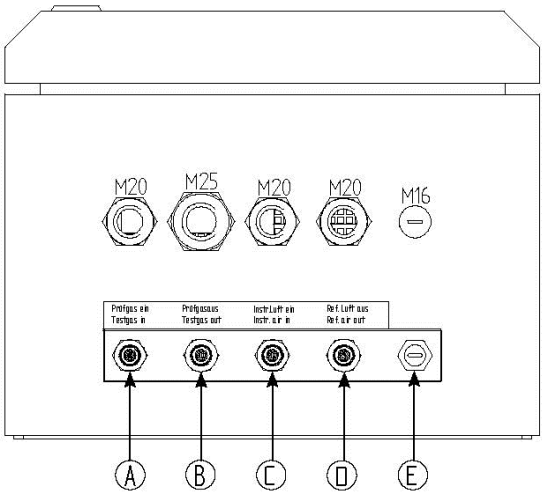
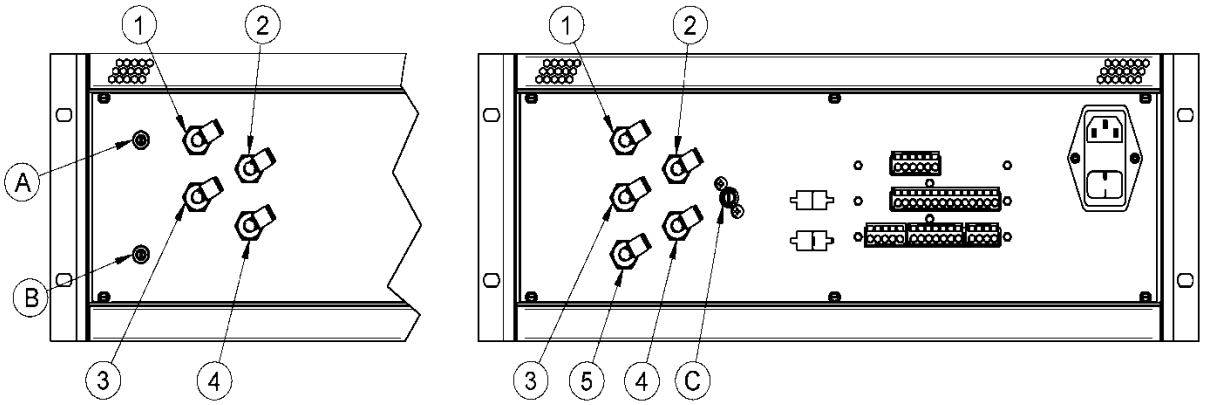


Figure 16 - Bottom view of the electronic unit with integrated pneumatics

No.	Tube	Pump version	Instrument air version
Ⓐ	1/4“	Test gas in	Test gas in
Ⓑ	1/4“	Test gas out	Test gas out
Ⓒ	1/4“	Reference air in	Instrument air in
Ⓓ	1/4“	Reference air out	Reference air out
Ⓔ	1/4“	Test air in	



Instrument air version **Pump version**

Figure 17 - Back view of the 19” 4HE electronic unit showing pneumatic connections

No.	Tube	Pump version	Instrument air version
1	1/4“	Test gas in	Test gas in
2	1/4“	Test gas out	Test gas out
3	1/4“	Reference air in	Instrument air in
4	1/4“	Reference air out	Reference air out
5	1/4“	Test air in	

A	Regulator Reference Air
B	Regulator Test Air
C	Regulator Test Air

3 Initial Operation

3.1 Checklist before commissioning the system

- Is the serial number of the probe identical to the serial number of the electronic unit? If not, change the assignment.
- Does the voltage specified on the name plate correspond to the line voltage? (See section ***1.7 - Name Plates***)
- Is the electrical wiring connected correctly? (See section ***2.6 - ZIRKOR200 Wiring Diagram***)
- Are the pneumatic connections correct and gas tight? (See sections ***2.15 and 2.16 - Pneumatic Connections***)
- Make sure that there are no leakages at the probe - e.g. is the counter flange welded gas tight to the duct and are the flange bolts tightened sufficiently? Are gaskets in use? (See section ***0 - Mounting of the Probe***)
- Do the conditions at site match the specification in the data sheets? (See section ***A - Technical Data***)

3.2 System Power Up

Switch on the line voltage to the system. After a short power up information, the user is prompted to **Select language**, set the **System date**, **System time,** enter a **TAG number** and **REMOTE code** (only if option REMOTE is factory activated).

The probe heating phase now begins which is followed by the measuring mode.
A 2-point calibration must be carried out 24 hrs after commissioning.

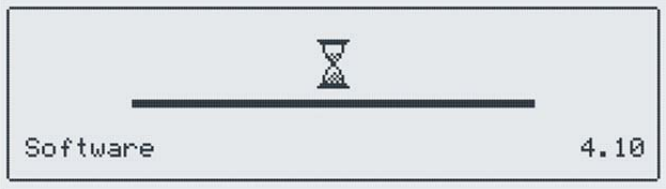


Figure 18 - System Power up. Note the software version at the bottom right of the display.

3.3 Display - Probe Heating Phase

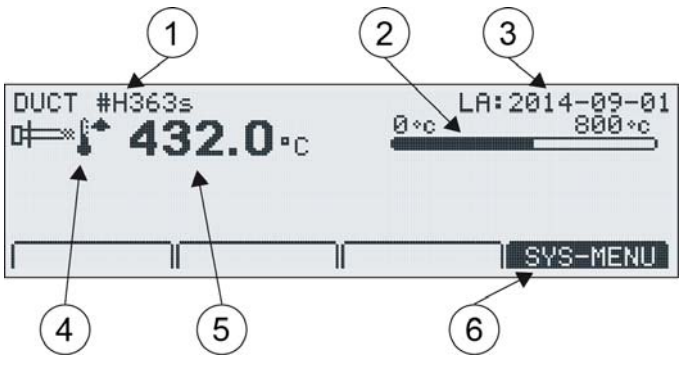
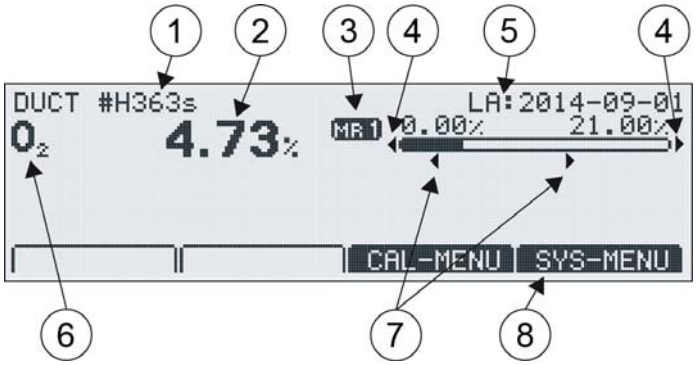


Figure 19 - O_2 sensor heating phase

The probe heating phase begins with the heating up of the O_2 sensor.		
①	TAG number	
②	Analogue temperature bar	
③	Last access with corresponding date	
④		Rising probe temperature
		(or) waiting period
		(or) heater error
⑤	Current temperature	
⑥	Soft key title: e.g. System menu	

3.4 Display - Measuring Mode

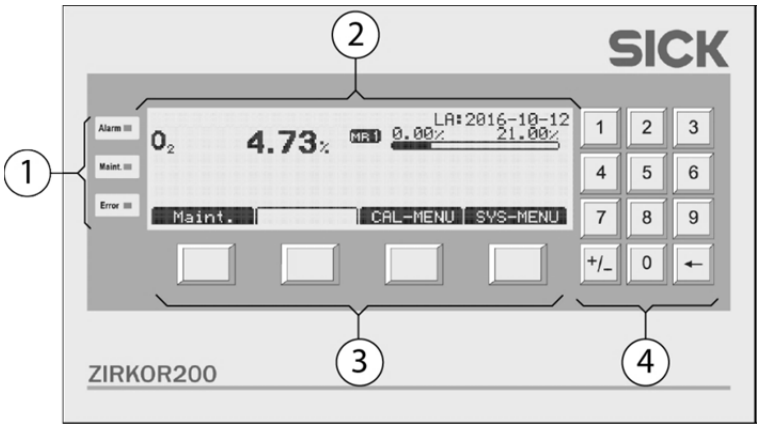


1	TAG number
2	Measured value
3	Active measuring range
4	Blinking indicators showing under or over measuring range
5	Last access
6	Measured component
7	Limit alarm indicators min-Alarm / max-Alarm *
8	Soft key titles

Figure 20 - Measuring mode

* Only if the O_2 limit alarms are switched on and the limits are within the set measuring range.

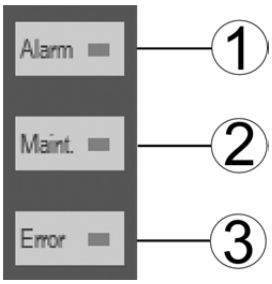
3.5 Keypad and Display



The controls and display of the ZIRKOR200 are housed in the electronic unit and are comprised of:	
1	Three LED indicators depicting active status reports for limit alarms, maintenance and system faults
2	Graphic enabled, back-lit display
3	Four soft keys with varying layout (soft keys)
4	Numeric number bloc

Figure 21 - Keypad and display

3.6 Status LEDs



Alarm, - orange - is lit when an alarm has been activated (e.g. O_2 limit alarm)

Maint. - Orange - a function has been accessed which may affect the measurement

Error - red - is lit when a system error has occurred

3.7 Soft key Symbols

- Moves the selection one position upwards
- Moves the selection one position down-wards
- Leave an area
- Abort a function or entry
- Select or confirm a function/value

3.8 System Code

Info

The system code on delivery is 0000. In this state, entry into the system is granted without having to enter the system code. The system code protects the system from unauthorized use. Functions which may alter the measurement of O_2 are therefore also protected.

Caution: If the system code has been altered, it must be kept in a safe place!

4 Software Overview and Explanations

4.1 Menu Overview - SYS-MENU

SYS-MENU

- **System Information**
- **Actual measured values**
  - O_2 measured value (% O_2) {may be ppm}
  - O_2-mA output 17A/B (mA)
  - O_2 sensor input (mV)
  - Flow rate reference air (l/h)
  - O_2 probe temperature (°C / °F)
  - O_2 probe heater power (%)
  - Thermocouple input (mV)
  - Terminal temperature (°C / °F)
  - Internal temperature (°C / °F)
  - Process pressure (rel) (mbar/psi) } *only visible with optional Pressure Compensation*
  - O_2 sensor life (%)
  - Lambda
- **Calibration results**
  - e.g. 2012-05-11 (Choose date/time)
    - Executed at
    - Calibration method
    - O_2 sensor calibration
    - ~~ Calibration results ~~
    - O_2 value at test air (20,95 % O_2)
    - ♦ calibrated to (% O_2)
    - O_2 value at test gas (% O_2) } *only if determined*
    - ♦ calibrated to (% O_2)
    - ~~ Calibration data ~~
    - O_2 sensor offset (mV)
    - O_2 sensor slope (mV / dec) } *only 2 point calibration*
    - ~~ Test gas data ~~
    - Test air (20,95 % O_2)
    - Test gas (e.g. 2,1 % O_2)
    - ~~ Sensor raw data~~
    - O_2 voltage at test air (mV)
    - ♦ at pressure (mbar/psi)
    - O_2 voltage at test gas (mV) } *only if determined*
    - ♦ at pressure (mbar/psi)
    - O_2 response to test gas (s) } *only if determined*
    - O_2 response to process (s) } *only if determined*
    - O_2 sensor life
- **Device operating data**
  - Powers on counter
  - Hours in operation
  - Min. internal temperature
  - Max. internal temperature

Software version and options

Software ZIRKOR200
~~ Options ~~
♦ .....

SYS-MENU

System configuration

O_2 Measuring ranges

Meas.range 1 from (% O_2, ppm O_2)
Meas.range 1 to (% O_2, ppm O_2)
Meas.range 2 from (% O_2, ppm O_2)
Meas.range 2 to (% O_2, ppm O_2)
Meas.range select by (dig.input / keypad)
Meas.value averaging for (s)
Conversion wet → dry (% H_2O)
mA output type (0-20 mA / 4-20 mA)
mA output on system error (mA)

O_2 limit alarms

O_2 limit alarm 1 (OFF/ON)
♦ at
♦ hysteresis
} *visible when set to "ON"*

O_2 limit alarm 2 (OFF/ON)
♦ at
♦ hysteresis
} *visible when set to "ON"*

O_2 sensor calibration values

O_2 cal.value - offset (mV)
O_2 cal.value - slope (mV/dec)

Calibration settings

Time per test gas apply (Min.)
Delay time to process (Min.)
Measurement value hold on calibration (ON/OFF)
Auto. calibration (ON/OFF)
♦ Calibration method (O_2 1-Point / 2-Point) } *visible when set to "ON"*
♦ Test gas (bottle value % O_2) { when preset to 2-point} } *visible when set to "ON"*
♦ Start by (Time, dig. Input, both) } *visible when set to "ON"*
♦ Interval (days)
♦ next ACAL at (set date)
} *not applicable with dig.input*

Pressure compensation (Optional)

- Pressure input from (mbar)
- Pressure input to (mbar)
- Location altitude (m)

System clock/TAG number

- System date (yyyy-mm-dd)
- System time (hh:mm:ss)
- TAG

REMOTE settings (optional) } *Visible when REMOTE interface is activated*

- REMOTE (ON/OFF)
- REMOTE code (8 digit code) } *Visible when REMOTE is ON*
- Range (Short / Medium / Maximum)

Measuring units

- Temperature (°C / °F)
- Pressure (mbar / psi)

Language

- Choose language (Deutsch / English / Spanish / Polish)

Change system code

Load factory settings

Service

4.2 Software Explanations - SYS-MENU

4.2.1 O_2 Measuring Ranges (Scaling)

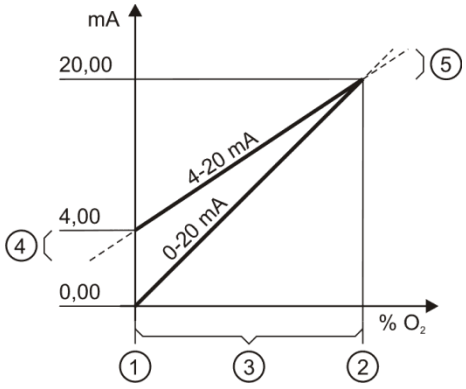


Figure 22 - O_2 Measuring Ranges

The O_2 Measuring range (3) is linearly scaled and converted to a linear current output (0/ 4-20 mA).

The parameter „O_2 Measuring range from“ (1) is the start value of the O_2 range, leading to an analogue output of 4,00 mA.

„O_2 measuring range to“ (2) is the end value of the O_2 range, leading to an output of 20,00 mA.
If a measured value is lower than the start value of the O_2 measuring range, the current output signal drops to 3,60 mA.

(If the current output is set to 0- 20 mA the output is 0 mA)

If the measured O_2 value is higher than the end value of the O_2 measuring range end, the analogue output rises to 20,40 mA.

If during normal operation the measured O_2 value is under, (4) or over (5) the programmed measuring range, an error message appears on the display (in measuring mode).

4.2.2 Measuring value averaging for

This entry sets the duration for the continuous average measurement (flowing average). During a calibration or sensor verification, the measurement average is not shown, though still active for the analogue output.

4.2.3 mA output on system errors

The mA output value for a system error is specified in range of 0 - 3,55 mA or 20,41 to 20,80 mA. The mA output value for a system error cannot be set in the mA measuring range.

4.2.4 O_2 limit alarm settings

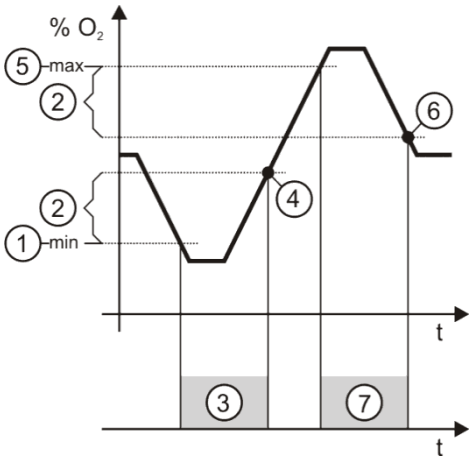


Figure 23 - O_2 limit alarm settings

The entry "by" sets the value at which the O_2 limit alarm is activated.

The O_2 limit alarm function "min" (1) defines a value by which the limit alarm (3) is activated if the measured O_2 value falls below the set limit.

If the hysteresis is set to greater than 0,00, (2)
the limit alarm is reset when the measured O_2 value rises above the set O_2 limit plus the hysteresis value (4).

The O_2 limit alarm function "max" (5) defines a value by which the limit alarm (7) is activated if the measured O_2 value rises above the limit.

If the hysteresis is set to greater than 0,00, (2)
the limit alarm is reset when the measured O_2 value falls below the O_2 limit minus the hysteresis value. (6)
If the hysteresis is set to 0,00 % O_2, the triggered limit alarm must be manually reset.

4.2.5 O_2 Sensor calibration values

Info

The sensor calibration values can be altered through a 1 or 2 point calibration. Manual entry of values is only necessary after replacing the O_2 sensor. (The sensor calibration values, "cell constant" and "cell slope" can be found on the probe test protocol for new probes.)

4.2.6 Time per test gas apply

Here the maximum duration of time for the application of test gas or test air is set. If sensor stability is not reached within the maximum time, the following error message is displayed: "**O_2 Sensor calibration failed - O_2 sensor signal instable**" This problem can be offset by setting a longer duration. The factory setting for maximal duration is 10 Minutes. If necessary, the time can be adjusted between 5 minutes and 30 minutes.

4.2.7 Delay time to process

Here the delay time showing the last measured O_2 value from the data storage is frozen after test air or test gas has been applied (only when "Meas. value hold on cal. is set to on) This value also sets the time for showing the trend representation on the display after test air or test gas application after a sensor calibration is set.

4.2.8 Automatic Calibration (ACAL)

Automatic calibration enables a cyclic, time-based or remote controlled calibration (using the digital input) of the O_2 sensor. The ACAL can be globally switched on or off and can only be started from the main screen of the display.

When a 2 Point ACAL is set, a test gas bottle must be permanently connected and turned on.

Info

Make sure that the test air and test gas volume and flow settings needed for calibration are correct.
For systems with flow monitoring: The flow rates can be checked under

System Checks → O_2 sensor check
For systems without flow monitoring: Check the flow rates through an external flow meter and adjust to 150 - 180 l/h via an external throttle valve.

4.2.9 Automatic Calibration Settings

Only when the ACAL is switched on, are the ACAL settings visible. The calibration method determines whether the ACAL is carried out as a 1 point calibration only with test air (instrument air or ambient air) or as a 2 point calibration with test air and test gas. Ambient air is preset to a fixed O_2 concentration of 20.95% and this value is not shown nor can it be changed.

The ACAL can be started by:

Time: Time based start with set intervals in days and the corresponding time

Time + Digital Input: Same as "Time", additionally a control voltage of 12-24V DC must be applied to the "calibration release" so that an automatic calibration can be started.

Digital Input: A control voltage of 12-24V DC must be applied to the "calibration release" so that an automatic calibration can be started. If the control voltage is still present after the calibration has ended, the calibration will immediately restart

4.2.10 REMOTE

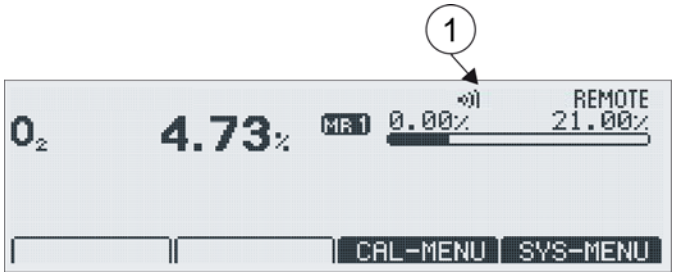
Info

If the REMOTE is set to "OFF", password and range are not displayed.

The REMOTE password is used for:

- authentication and pairing with a smartphone / tablet / laptop / pc.
- authentication / login after every connection. Without Authentication / login, device data cannot be read or modified. The device configuration can also not be altered.

Range limits the transmission power of the REMOTE module. **Maximum** = 100m, **medium** = 10m, **short** = 1m. The actual possible range may vary due to structural factors and the reception strength of the Smartphone/Tablet.



When a REMOTE connection to the analyzer is active, the connection is shown in the upper right corner of the display ①.

Figure 24 - REMOTE connection active

Info

A maximum of 16 users (smartphones /tablets) can connect to the REMOTE module of an analyzer.

Should additional users attempt a connection, the connection will fail. In this case, manually switch off the REMOTE and switch it back on again **SYS MENU => System configuration => REMOTE Settings** which will reset the module.

All previously paired users will need to delete their saved connection to the analyzer and re-pair their devices.

4.2.11 Measuring units

Measuring units can be set for temperature (°C / °F) and pressure (mbar / psi).

4.2.12 Language

Set the language for all text shown on the display. One can choose between English, German, Spanish and Polish.

4.2.13 Change system code

Info

The system code on delivery is 0000. In this state, entry into the system is granted without entering the system code. For security reasons, change the code and store it in safety. In case of loss of the system code, a system reset has to be carried out. The reset process may only be carried out by trained service technicians. As an option, a 6 digit code is available.

4.2.14 Load factory settings

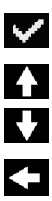
Loading factory settings will restore all original settings and values to the default values programmed in the factory. If activated, all set parameters and also values such as sensor calibration values and calibration results are lost. Take note of the sensor calibration values beforehand and re-enter them after the loading the factory settings. If this is not done, a calibration has to be carried out.

4.2.15 Service (Factory Service Settings)

The service functions are password protected and are only accessible by trained service personnel. These functions are protected with a code, different to the system code.

4.3 Calibration Menu

CAL MENU



1 point calibration, O_2

2 point calibration, O_2

4.3.1 Calibration Menu - Display Overview

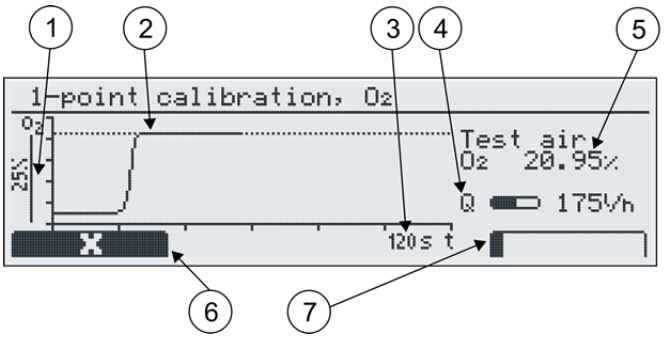


Figure 25 - display of a 1 Point Calibration

1	The max. adjustable measuring range
2	Trend representation of measured O_2 value and O_2 target value The target value is determined by the O2 concentration in the test gas / test air
3	Time scale showing the elapsed time of the current calibration process. The amount in seconds (here 120 s) refers to the end of the time scale
4	The flow rate currently measured
5	Current measured value of O_2
6	Abort the calibration
7	Progress bar

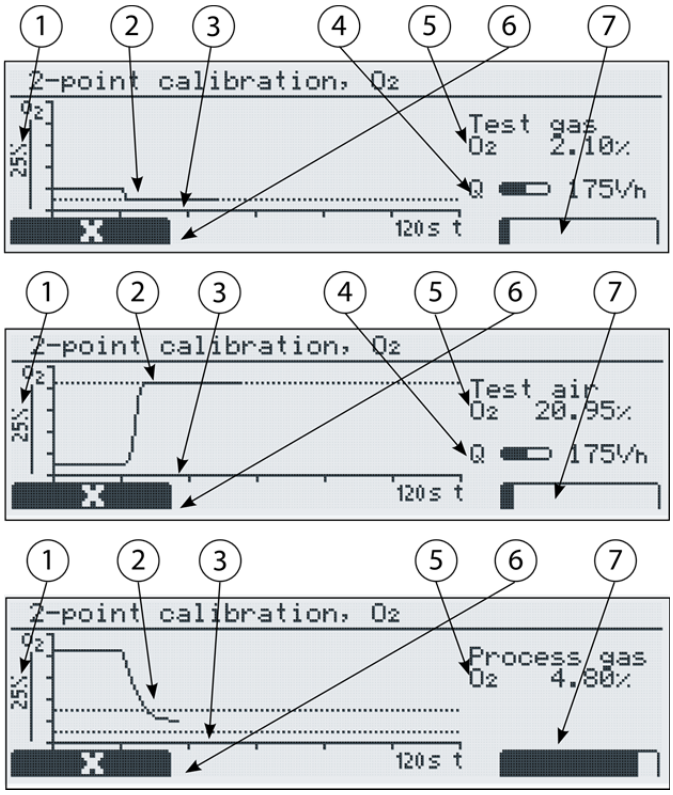


Figure 26 - The 3 phases of a 2 point calibration, Test Gas apply, Test Air apply and Return to Process gas.

	Info The oxygen concentration in test air needs not be entered as it is known (20,95 % O_2). During calibration, entry of the test gas concentration value takes place after test gas has been applied.

4.3.2 1-point calibration (manual)

During the 1-point calibration of the sensor, the calibration offset is determined. Test air is hereby applied to the sensor. In systems without an integrated pneumatic unit, test gas needs to be applied manually and the flow control also may need to be checked and adjusted if necessary.

Course of events

(1) Enter System Code

(2) Maintenance LED is lit

(3) Prompt to apply test air *(only for systems without flow monitoring)*

(4) The calibration process is carried out with test air

(5) Prompt to end the test air application. *(only for systems without flow monitoring)*

(6) Display of the return to process if the difference between the measured concentration in the process and the O_2 concentration with test air is more than 3.00%.

(7) Enter the O_2 concentration of test gas *(does not apply to test air)*

(8) Display of the calibration results (max. 1 minute)

(9) Maintenance LED switches off *(is delayed by the set value in "Delay time to process" if "Meas. Value hold on cal" is set ON)*

(10) Revert to main display

4.3.3 2-point calibration (manual)

During the 2-point calibration of the sensor, the calibration offset and slope is determined. Hereby two gases are applied to the sensor (test air and test gas. In systems without integrated pneumatic units, test gas needs to be applied manually and the flow control also may need to be checked and adjusted if necessary.

Course of events

(1) Enter System Code

(2) Maintenance LED is lit

(3) Prompt to apply test gas *(only for systems without flow monitoring)*

(4) The calibration process is carried out

(5) Prompt to apply test air *(only for systems without flow monitoring)*

(6) The calibration process is carried out with test air

(7) Prompt to end the test air application. *(only for systems without flow monitoring)*

(8) Display of the return to process if the difference between the measured O_2 concentration in the process and the concentration with test air (test gas 1) is more than 3.00%.

(9) Prompt to enter test gas concentration(s)

(10) Display of the calibration results (max. 1 minute)

(11) Maintenance LED switches off *(is delayed by the set value in "Delay time to process" if "Meas. Value hold on cal" is set ON)*

(12) Revert to main display

4.4 System Checks

O_2 Sensor checks

Source: **Test air**
O_2 sensor .. mV = .. %
Flow rate .. l/h

Source: **Test gas**
O_2 sensor .. mV = .. %
Flow rate (3 bar max) .. l/h

Source: **Process**
O_2 sensor .. mV = .. %
Flow rate .. l/h

Check mA outputs

Set mA output 17A/B (mA)

Check relay outputs

Relay contact at 18A/B (opened / closed)
Relay contact at 19A/B (opened / closed)
Relay contact at 20A/B (opened / closed)
Relay contact at 21A/B (opened / closed)
Relay contact at 22A/B (opened / closed)

Check digital inputs

Input status at 25A/B
Input status at 27A/B

Check mA inputs

Check mA input at 29A/B

5 Service and Maintenance

5.1 Exchange fuses

⚠	**Warning** De-energize system first!

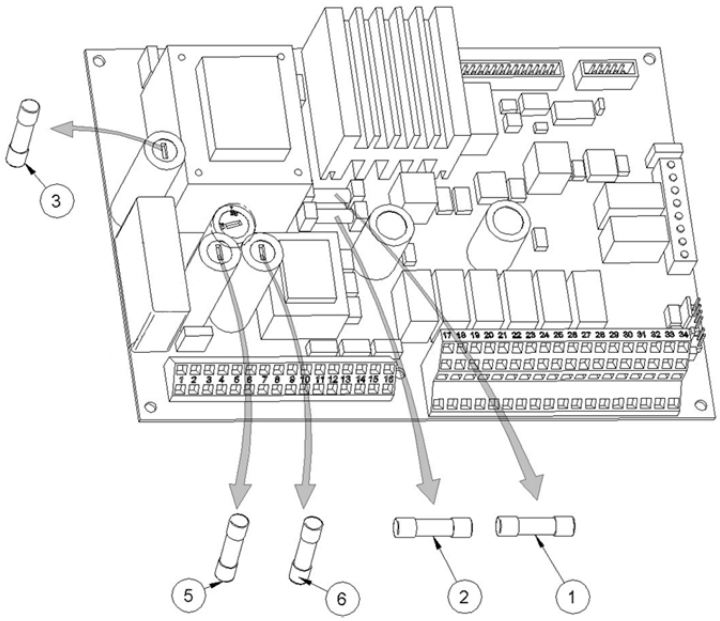
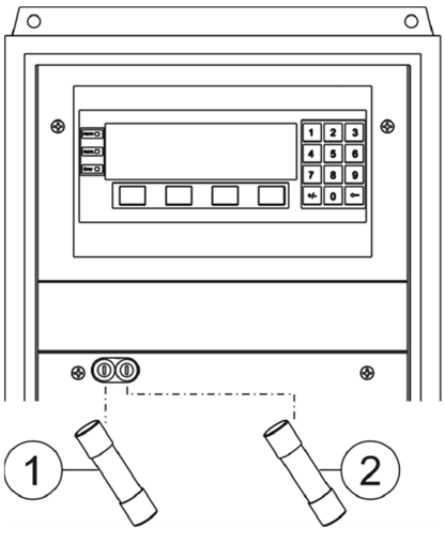


Figure 27 - Position of the fuses

	Part	Current	Type of Fuse	Task
①	F3	1 A	fast-acting 5x20 mm glass tube fuse	Protection of the electronic unit
②	F4	1 A	fast-acting 5x20 mm glass tube fuse	Protection of the electronic unit
③	F5	1A	semi time-lag 5x20 mm glass tube fuse	Protection of the solenoid valve and ref. air and test air pumps
⑤	F1	6.3 A	semi time-lag 5x20 mm glass tube fuse	Protection of the entire system
⑥	F2	4 A	semi time-lag 5x20 mm glass tube fuse	Protection of the probe heater



No.	Article no.	Description
①	2089370	F1, Main Unit fuse 6,3A Semi time lag 5x20 mm (glass-tube fuse)
②	2089370	F2, Probe heater fuse 4A Semi time lag 5x20 mm (glass-tube fuse)

Figure 28 - Electronic unit main fuses

5.2 Flow rates for Test Air and Reference Air

The systems are factory-set to the correct amounts of test air and/or reference air. The instrument air versions are designed for an inlet pressure of 1-10 bar. With a higher inlet pressure of 6 bar, it is necessary to readjust the flow of reference air and/or test air.

The flow rates for air should be in the following range:

Test air: 150l/h - 180l/h

Reference air: 30l/h - 40l/h

5.3 Adjusting Flow Rate (integrated Pneumatics)

In the instrument air version in the Safe Area housing with an integrated pneumatic unit, it is possible to adjust the reference and test air at the electronic unit. In this respect, the pump and instrument air versions are different:

- In the pump version ambient air is used. Only the flow rate of test air can be adjusted.
- The instrument air version requires an external supply of clean, dry and oil free air (instrument air) Both flow rates (test air and reference air) can be adjusted.

In systems with integrated pneumatics unit, the flow rate of reference air can be seen in the menu actual measured values.

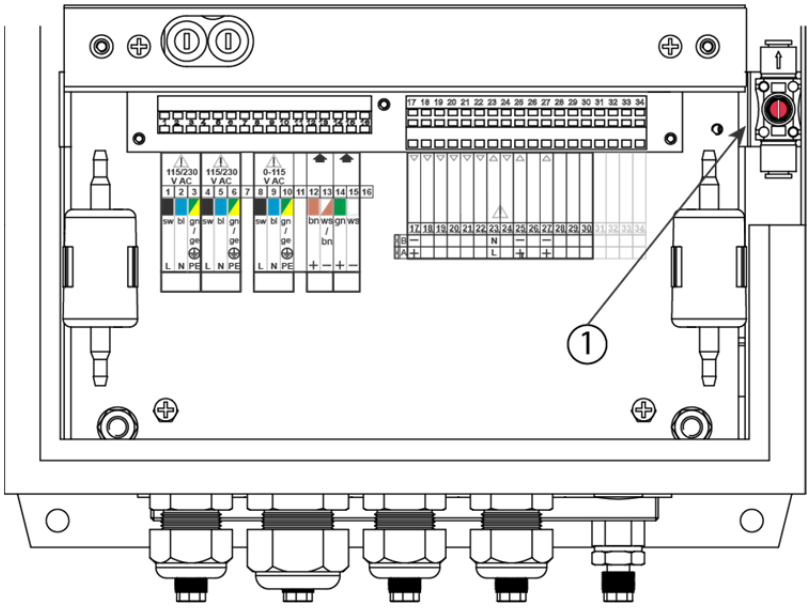


Figure 29 - Adjust flow of test air ① - (pump version)

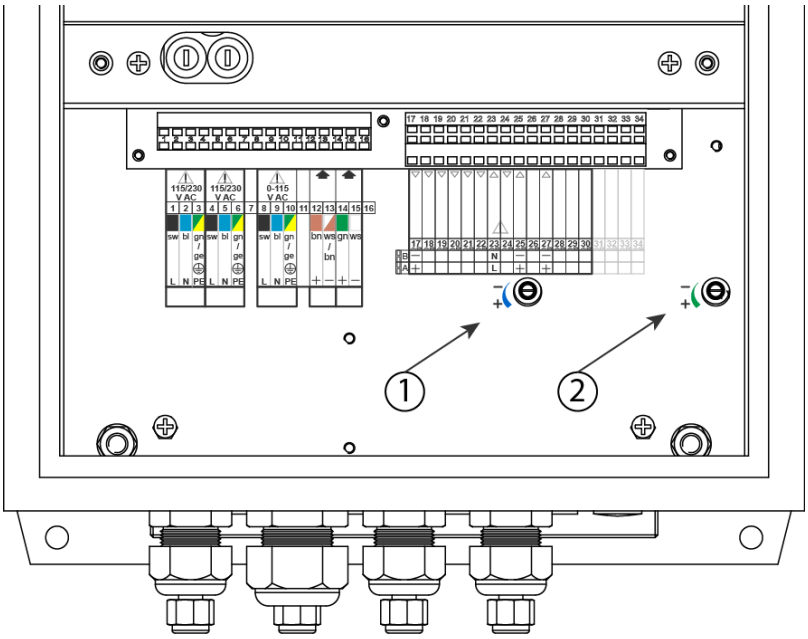


Figure 30- Adjust flow of reference air ① and test air ② - (instrument air version)

5.4 Position of the adjustment valves

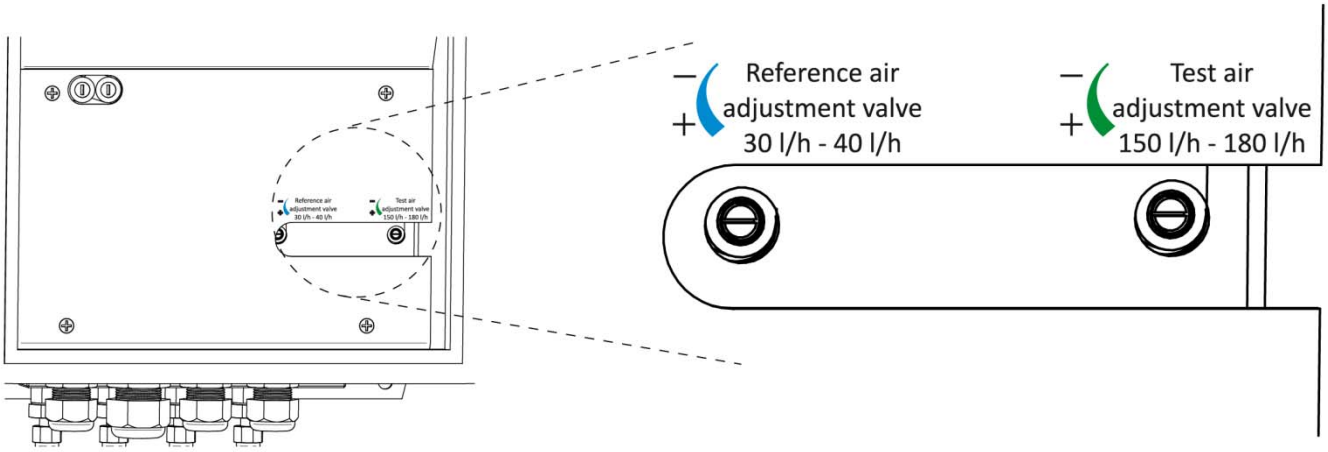


Figure 31- Terminal cover of the Electronic Unit
showing the position of the reference air and test air valves below

5.5 Adjusting Flow Rate (19” 4HE)

With systems in 19“ racks the reference air and test air quantity can be adjusted at the back of the electronic unit.

There are differences between the pump and the instrument air version:

- In the pump version, only the flow rate of test air can be adjusted.
- In the instrumental air version, both flow rates (test air and reference air) can be adjusted.

In systems with integrated pneumatics unit, the flow rate of reference air can be seen in the menu “Actual measured values”.

Instrument air version **Version with pumps**

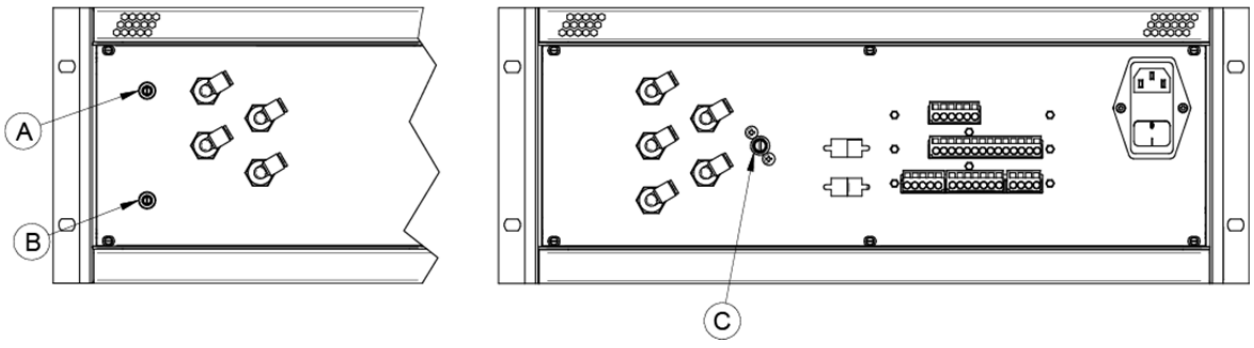


Figure 32 - Adjusting the flow rate at the 19” 4HE unit

A	Regulator Reference Air
B	Regulator Test Air
C	Regulator Test Air

5.6 Replacing the probe

Warning Hot Surface

The probe may only be removed with heat-insulated gloves.
Before removing the probe, always switch off the supply voltage to the electronic system.

1. Disconnect the wires at the probe connection box.
2. Loosen the bolts connecting the probe to the counter flange and remove the probe
3. Insert the replacement probe using a new gasket. Consider the flue gas direction and adjust the V-Shield (filter head) accordingly. See chapter ***2.10 – Adjusting the V-Shield.***
4. Tighten the flange bolts and reconnect the wiring at the connection box.
5. Switch on the power to the analyzer and wait for the probe to reach its set point temperature.
6. Carry out a 2-point calibration (under process conditions)

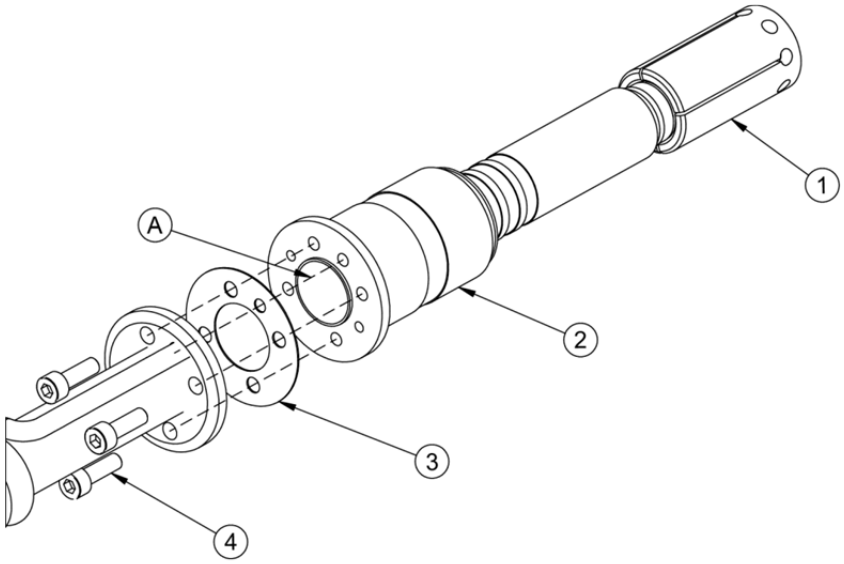
5.7 Replacing the O_2 Sensor

Warning Hot Surface

The probe may only be removed with heat-insulated gloves. Before removing the probe, always switch off the supply voltage to the electronic system. After removal, store the probe in a safe, protected place and wait until it has cooled down below 35°C/ 95°F.

Note

An exchange of the measuring cell is only necessary if the cell is leaking (erratic or incorrect measured values).



Disconnect the wires in the connection head and loosen the 2 torx screws, which hold the inner parts of the tube. Pull off the thin transparent reference air pipe from the entry fitting at the connection box.

Pull out probe internal assembly carefully (4-hole ceramic rod with signal measuring wire, thermocouple element and heater)

Unscrew the 4 torx screws at the measuring cell holder with flange and remove the measuring cell.

Figure 33 - O_2 sensor replacement

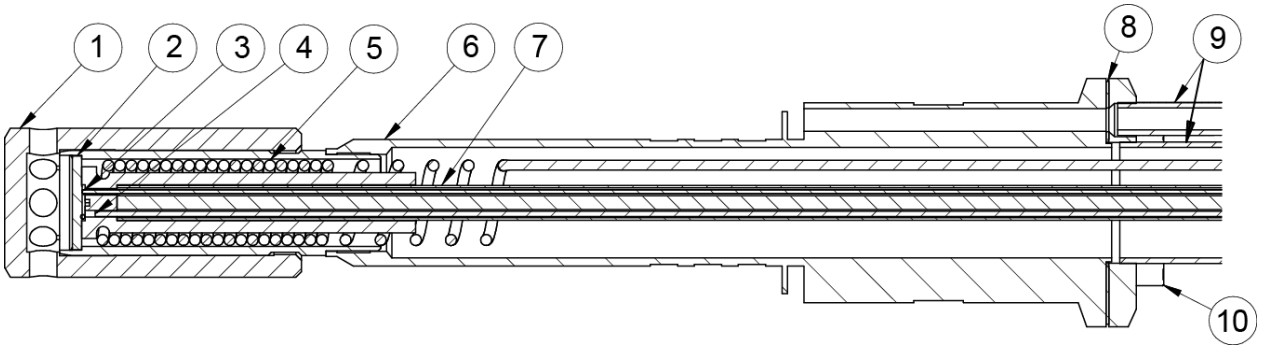
(1)	Protection cap
(2)	Measuring cell holder with flange
(3)	Measuring cell flange gasket
(4)	Screws M5 x 12
(A)	Align the holes of the test gas tube, cell flange gasket and measuring cell, also aligning the threaded holes for the screws.

Clean the flange at the probe tube with fine sandpaper. Tighten the new measuring cell with a new metal gasket sealing and four new screws at the measuring cell flange of the probe tube. Insert the probe inner parts and ensure that the inner parts do not bind in the probe tube. Press the locking bolt against the spring, so that the inner parts assembly is pressed against the measuring cell with enough spring tension.

Tighten locking bolt and connect wires as follows:

Terminal	Color	Description	Polarity	Unit
1	Green / yellow	signal wire, measuring cell	-	mV
2	Orange	signal wire, measuring cell	+	mV
3	Green	thermocouple element	+	mV
4	White	thermocouple element	-	mV
6	Black	heating element		
7	Blue	heating element		
8	Green / yellow	ground/earth heater		
9	Grey	solenoid valve (optional)		
10	Grey / blue	solenoid valve (optional)		

Install the probe; wait for the system to reach its operating temperature. Carry out an O_2 two point calibration after 2 hours of operation.

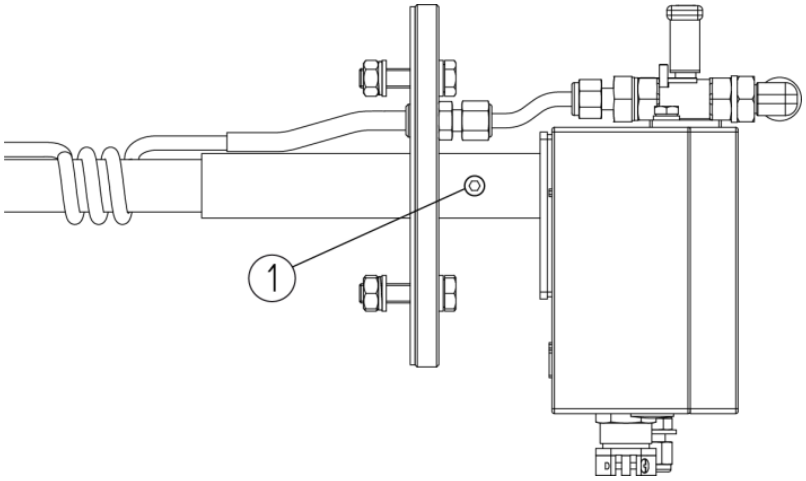


①	Protection cap	⑥	Cell tube
②	Cell	⑦	Ceramic rod
③	Signal wire	⑧	Flange gasket
④	Thermocouple	⑨	Probe tube
⑤	Heater	⑩	Screw M5

Figure 34 - Construction of the O_2 sensor holding tube

5.8 Exchange of Probe Inner Parts

Proceed as described in **chapter 5.7** to dismantle the probe inner parts assembly. The exchange of the thermocouple element is an exception, because this can be changed without dismounting the probe inner part as a whole.



Disconnect the wires in the connection box and loosen the 2 allen screws (1), which hold the inner parts of the probe. Pull off the thin transparent reference air pipe from the entry fitting at the connection box.

Pull out probe internal assembly carefully (4-hole ceramic rod with signal measuring wire, thermocouple element and heater)

Figure 35 – Loosen the allen screws holding the probe inner part

5.9 Relay Outputs / Functions and Correlation

The relay contacts are designed for 24V and 1A ~, 1A = (Exception: probe valve)

Relay	Contact	Function	Terminal
System error*	Normally closed	Signals operation-critical errors	X5 (19A/B)
Maintenance	Normally open	System code entered, system in maintenance mode	X5 (18A/B)
Measuring range	Normally open	Closed: Measuring range 1 active	X5 (20A/B)
Probe valve**	Normally open	Triggering of the probe valve	X5 (24A/B)
Limit value 1	Normally closed	Signals a violation of limit value 1	X5 (21A/B)
Limit value 2	Normally closed	Signals a violation of limit value 2	X5 (22A/B)

Relay outputs and functions

- The relay „system error“ is active also during the heating phase.

** The relay contact for the probe valve is designed for max. 230V and 1A ≅.

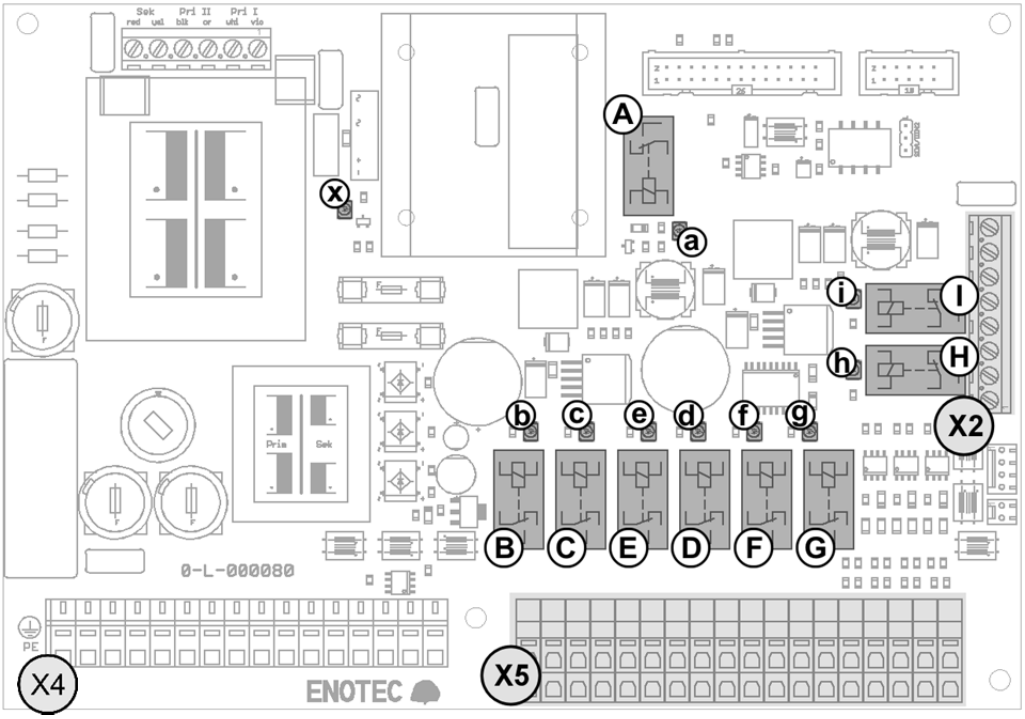


Figure 36 - Relay plate with marked relays and LEDS

Relay marking	LED Marking	Function
A	a	Probe heater relay
B	b	Maintenance
C	c	System error
D	d	Limit O_2 1
E	e	Measuring range
F	f	Limit O_2 2
G	g	Probe valve
H	h	Solenoid valve test gas 1
I	i	Solenoid valve test gas 2
	x	Probe heater control

5.10 Digital Inputs

The digital inputs are designed for a direct voltage of 12 V - 24 V DC for logical “High”. Logical “Low” corresponds to a voltage less than 1 V.

Digital input	Function
Calibration release	External release for calibration with ACAL
Measuring range switch	Switching on the second measuring range

5.11 Stability Criteria for Calibration

During calibration, the cell is checked for stability. This check operates according to the following criteria.

The last measured value is always temporarily saved. When the next value is outside the tolerance, the internal timer is reset and the new value temporarily saved. This means that if the timer was not reset, the value is stable. In this way, the last measured value after the timer has elapsed (2 min.) is used to calculate the cell constant or slope.

5.12 Reaction Time of the mA Output

The reaction time of the mA output to a change of the O_2 cell input voltage is less than 200 ms.

5.13 Extension Modules

As an option, the electronic unit is available with several interfaces (RS232, RS485, HART, Fieldbus). If one of these options is ordered you will find a separate manual/specification for the respective interface together with the shipment.

5.14 Maintenance Intervals

In general, maintenance as well as the maintenance intervals always depends on the flue or process gas conditions in which the probe is installed. Maintenance intervals may therefore vary between a few months up to a few years.

The biggest influencing factors are the presence of corrosive ingredients such as SO_2 or HCl, a continuous reducing atmosphere (reduced oxygen concentration, increased levels of combustibles) and the characteristics of the solid components in the flue gas.
These may have the following effects: chemical or mechanical destruction of the probe, clogging of the filter element or accelerated aging of the sensor. This may lead to a distortion of the measured values as well as an increase in the response time, which can in turn lead to false process operation afterwards.

For this reason, a sensor check is recommended with test gas and test air every six months. If a significant deviation between the values obtained and those presently anticipated, a 2-point calibration should be carried out. A visual inspection of the probe should be conducted at least annually, which includes cleaning of the filter element if necessary.

Notwithstanding these recommendations, the operator must define an appropriate maintenance interval which reflects the criticality of the measurement and the process.

6 Status Messages

6.1 Error Messages

Error Message	Relay contact	O_2 signal output	Description
Hardware error 1-7	System error, open	2.00 mA, when not set differently	The error can occur at any time and signalizes a failure of one of the electronic components. The O_2 sensor heater is switched off. Contact a service point, if the error returns after restarting the system.
Open circuit thermocouple	System error, open	2.00 mA, when not set differently	The error can occur at any time and signals a break in the circuit of the thermocouple. The O_2 sensor heater is switched off. Once the fault has been corrected, the error can be reset. **Possible causes:** contact problems of the thermocouple wire to the terminal points of the electronics or the sensor, sensor cable is damaged or the thermocouple is defective.
O_2 probe set point temp. not reached	System error, open	2.00 mA, when not set differently	The error can occur during the heating of the O_2 sensor (Max. 90 minutes). The O_2 sensor heater is switched off. An error reset can be carried out by the user in order to restart the heating process. **Possible causes:** F2 fuse defective, contact problem of the O_2 sensor heater wire to the terminal points of the electronics or the sensor, sensor cable is damaged, short-circuited thermocouple, reference air flow greater than 60 l / h, power supply too low, flow rate too high and / or temperature in the process too low , electronic failure.
O_2 probe temperature too low	System error, open	2.00 mA, when not set differently	The error can occur during measurement, indicating that the O_2 sensor temperature drops 20 ° C (68 ° F) below the set point temperature. The O_2 sensor heater is switched off. An error reset can be carried out by the user in order to restart the heating process. **Possible causes:** F2 fuse defective, contact problem of the O_2 sensor heater wire to the terminal points of the electronics or the sensor, sensor cable is damaged, short-circuit thermocouple, reference air flow greater than 60 l / h, power supply too low, flow rate too high and / or temperature in the process too low, electronic failure.
O_2 probe temperature too high	System error, open	2.00 mA, when not set differently	The error can occur during measurement, indicating that the O_2 sensor temperature has risen 20 ° C (68 ° F) above the set point temperature. The O_2 sensor heater is switched off. An error reset can be carried out by the user in order to restart the heating process. **Possible causes:** Process temperature too high, O_2 sensor cable to the transmitter connected incorrectly, electronic failure.
Open circuit O_2 sensor	System error, open	2.00 mA, when not set differently	The error can occur at any time and signals a break in the circuit of the O_2 sensor. Once the fault has been corrected, the error can be reset. **Possible causes:** contact problem of the O_2 sensor wire to the terminal points of the electronics and the probe, probe cable is defective, contact problem of the probe the inner part of the O_2 sensor.
O_2 sensor calibration failed	System error, open		O_2 sensor calibration has failed for one of the following reasons. An error reset can be carried out by the user. All corresponding entries are then reset as well.
Test gas flow rate too low	System error, open		The error can occur during an O_2 sensor calibration and signals an insufficient test gas flow. An error reset can be carried out by the user. A successful re-calibration also resets the error. **Possible causes:** test gas bottle empty, test gas flow incorrectly set, instrument air supply to the system does not exist.
Test gas flow rate too high	System error, open		The error can occur during an O_2 sensor calibration and signals a test gas flow which is too high. An error reset can be carried out by the user. A successful re-calibration also resets the error. **Possible causes:** test gas bottle empty, test gas flow incorrectly set, instrument air supply to the system does not exist.
O_2 sensor offset too low	System error, open		The error can only occur only during an O_2 sensor calibration. An error reset can be carried out by the user. A successful re-calibration also resets the error. **Possible causes:** inadequate reference air supply, process pressure is too high, incorrect test gas, O_2 sensor defective.

Error Messages (cont.)

Error Message	Relay contact	O_2 signal output	Description
O_2 sensor offset too high	System error, open		The error can only occur during an O_2 sensor calibration. An error reset can be carried out by the user. A successful re-calibration also resets the error. **Possible causes:** defective false test gas (not applicable with test air), test gas flow too low, O_2 sensor defective.
O_2 sensor slope too low	System error, open		The error can only occur only during an O_2 sensor calibration. An error reset can be carried out by the user. A successful re-calibration also resets the error. **Possible causes:** Incorrect calibration gas, test gas flow too low, probe filter damaged, filter head missing, faulty O_2 sensor.
O_2 sensor slope too high	System error, open		The error can only occur only during an O_2 sensor calibration. An error reset can be carried out by the user. A successful re-calibration also resets the error. **Possible causes:** Incorrect calibration gas, O_2 sensor defective.
O_2 sensor signal instable	System error, open		The error can only occur only during an O_2 sensor calibration. An error reset can be carried out by the user. A successful re-calibration also resets the error. **Possible causes:** test gas flow too low, probe filter is damaged, process pressure fluctuations too high.
mA input for process pressure	System error, open		Circuit open or pressure transmitter signal less than 3.6 mA / greater than 20.4 mA
Error REMOTE module	System error, open		Indicates a hardware error of the REMOTE module. **Possible cause:** the REMOTE module is defective.

Unlisted errors: Other errors cannot be remedied by the customer. Please contact a service point

6.2 Alarm Messages

Error Message	Relay contact	Description
Reference air flow too low		**Possible Cause:** reference air flow set incorrectly, instrument air supply is inadequate, reference air pump is faulty.
Reference air flow too high		**Possible Cause:** reference air flow is set incorrectly.
O_2 limit alarm 1	O_2 limit alarm 1, open	**Possible Cause:** Over or under range of the O_2 limit alarm.
O_2 limit alarm 2	O_2 limit alarm 2, open	**Possible Cause:** Over or under range of the O_2 limit alarm.
Electronic temp. too low		**Possible Cause:** The ambient temperature of the transmitter is lower than the specified lower limit. The specified measurement tolerances are no longer guaranteed.
Electronic temp. too high		**Possible Cause:** The ambient temperature of the transmitter is higher than the specified upper limit. The specified measurement tolerances are no longer guaranteed.
Clock battery low		The alarm can only be reset by the user after replacing the clock battery (Lithium type 2032). As long as the system is connected to AC power, the alarm has no impact. Only after restarting system will the time / date be incorrect. A possible timed automatic calibration can no longer work correctly.

Unlisted alarm messages: Other messages cannot be remedied by the customer. Please contact a service point

6.3 Maintenance Messages

Maintenance message	Relay contact	Description
Measured value(s) held	Service, closed	When ***measured values held*** is set to on, the determined O_2-mA output remains saved for a duration before a calibration.

7 Troubleshooting

Unsteady, widely varying measuring value (O_2)

Possible reasons	Procedure
Intermittent contact caused by wire breakage	Eliminate bad/loose contact
Intermittent contact inside the probe - internal mV connection	
Broken filter element	Visual inspection by dismounting the probe
Wrongly installed V-shield	
Probe has been installed without filter head	
Intermittent contact inside the probe – low spring tension for the O_2 signal contact wire internally	Check the spring tension

O_2 display remains at the end of the measuring range or is higher than expected

Possible reasons	Procedure
Leakages at the measuring probe or at the O_2 sensor flange seal.	Check all flanges and screw connections for tightness. Exchange O_2 sensor or replace O_2 sensor flange seal. In case of a leakage in the area of the O_2 sensor, the O_2 sensor must be exchanged.
Probe flange not gas tight.	Tighten flange bolts with required torque, possible renew the gasket.

Local Displays correct, Output not correct

Possible reasons	Procedure
Electronic unit is defective	Check measuring range. Check whether the current value is outside the measuring range
	Measure the mA output on the strip terminal.

O_2 Display Indicates 0 %, although the Process Operation Mode expects a higher O_2 Value

Possible reasons	Procedure
Measuring probe heater defective (resistance must be approx. 37.5-47.5 Ohm, disconnect probe and check).	Check the measuring cell temperature (set value 800°C/1472°F. A lower temperature could have the effect of showing a value of 0 %.
Thermocouple defective (check resistance, approx. 2-80 Ohm).	Check the mV value of the O_2 measuring cell
Fuse for heater voltage defective.	Replace the fuse
Cable short circuit. Electronic units input defective. Wire break	Check wiring. Measure probe cable.
Transformer (230/115V) is defective	Check the fuse
There is no mV contact in the probe (measuring signal wire) or it is interrupted. Combustibles in the flue gas. Measuring cell defective	Check whether the probe reacts to test gas. If it does, there may be a high proportion of combustibles in the flue gas. In this case, there are reducing conditions at the probe sensor, which reduce the oxygen content at the sensor surface. **Caution: Explosion hazard!**

A Technical Data

A.1 Technical Specifications - Electronic Unit

Housing:	Sheet steel ST37 RAL2004 (19” rack optional) (GRP optional)
IP Code:	Safe Area Housing: IP66 GFK cabinet: IP66 19“ housing: IP20
Display:	LC Dot Matrix 240 x 64 LED backlit
Keypad:	Membrane keypad
Signal LEDs:	Alarm, Maintenance, Error
O_2 measuring ranges:	2 x 0,00 to 25,00 Vol.% O_2
Accuracy:	± 0,2 % of measured value
Response time:	Change of 100mV at sensor input < 200ms
Manual or ACAL (Automatic calibration):	1 or 2 point (automatic calibration)
Mains Voltage:	230V ±10 % 50 to 60 Hz 115V ±10 % 50 to 60 Hz *(see Name Plate)*
Power consumption:	400 VA (heating phase) 200 VA (typical measuring mode)
Recommended fuse:	10A
Output signal O_2:	Active, 0/4 to 20 mA max. load 500 Ω
Relay contact:	24 V AC/DC, 1 A
Relay contact solenoid valve:	230 V AC/DC, 1 A
Dimensions (W x H x D)**:**	300 x 440 x 240 mm (W x H x D) - (standard field housing) 482,6 x 177 x 400 mm (W x H x D) - (19” rack)
Weight:	Approx. 19 kg Approx. 12 kg (19” rack)
Temperature range - storage: *	-40 °C to +80 °C
Temperature range - operation: *	-20 °C to +55 °C (Pump version -20°C to +50°C)

* Other temperature ranges on request

A.2 Technical Specifications - Probe

Process gas temperature:	ZIRKOR200: up to 600°C (For all probes - up to 1600°C with cooling protection tube)
Insertion depth:	ZIRKOR200, length 1: 520 mm ZIRKOR200, length 2: 950 mm ZIRKOR200, length 3: 1835 mm ZIRKOR200, length 4: 2768 mm ZIRKOR200, length 5: 3682 mm
Immersion depth with cooling tube:	500 mm / 1000 mm Others on request
Measuring principle:	Zirconium oxide
Operating temperature O_2 sensor:	800 °C
Raw signals from O_2 sensor:	Air (20,95 % O_2: 0 mV ± 1mV 2,1 % O_2: 50 mV ± 1 mV
O_2 Sensor Reference Air:	Instrument air 40 l/h Adjustment at electronic unit
Process gas pressure:	-50 to +50mbar
Flow Velocity:	0 to 50m/s
Ambient temperature:	-40°C to +80°C
Reaction Time:	0,5s (Process flow velocity > 10m/sec.)
T90:	5s (Process flow velocity > 10m/sec.)
Probe material:	V4A (DIN 1.4571 / SS316Ti)
IP Code:	IP65
Detection limit:	< 1ppm O2
Power supply:	Through electronic unit

A.3 Gas Supply - Systems with Instrument Air

The analyzer system uses the connected instrument air continuously for the supply of reference air, and during calibration and system test respectively, for the supply of test air (test gas 1).

Instrument air supply for reference air / test air	
Specification:	According to ISO 8573-1 class 2 (Particle size max. 1µm, Particle density max. 1mg/m³, Oil content max. 0,1mg/m³, Pressure dew point max. -40 °C) Constant 20,95 Vol % O_2
Input pressure:	2-10 bar
Flow rate	continuously maximum 40 l/h (for reference air supply) 180 l/h during calibration

Test gas (test gas bottle) for calibration / system test	
Input pressure:	max. 3 bar
Specification test gas 1 (optional):	21 Vol. % O_2 in N_2 (synthetic air – in case instrument air is not available)
Specification test gas 2:	2.1 Vol. % O_2 in N_2 (accuracy +/- 2%)
Flow rate	180 l/h at 1,1 bar (+/- 0,1).

Note

The flow rate of the test gas bottle is set via the bottle pressure regulator.

B Dimensional drawings

B.1 Dimensions of Electronic Unit Housing versions

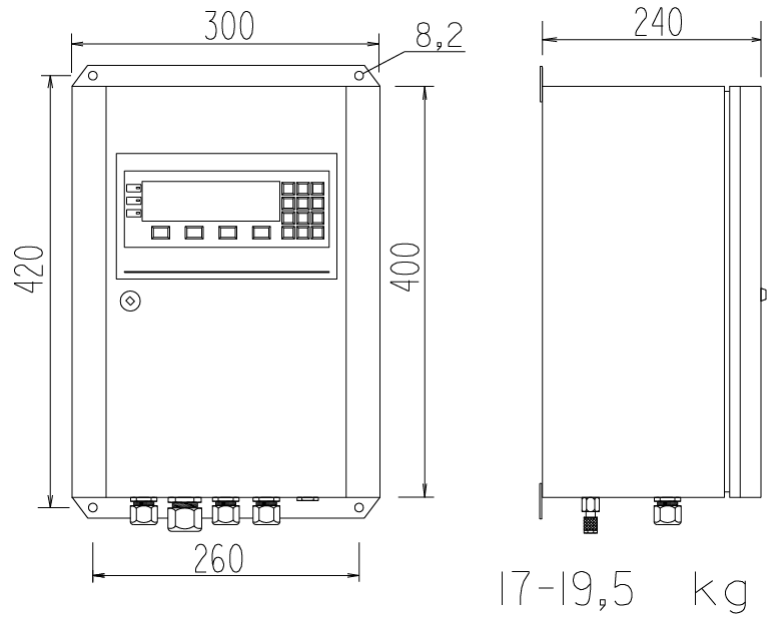


Figure 37 – Dimensions in mm of the field housing

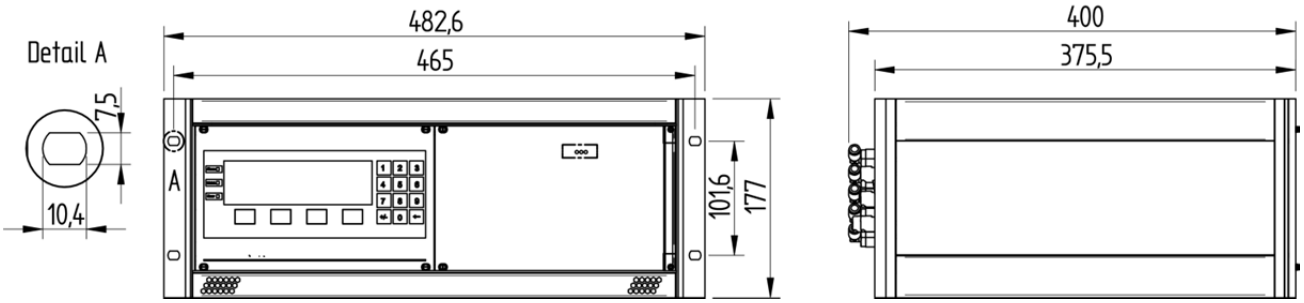


Figure 38 - Dimensions in mm of the 19” 4HE electronic unit

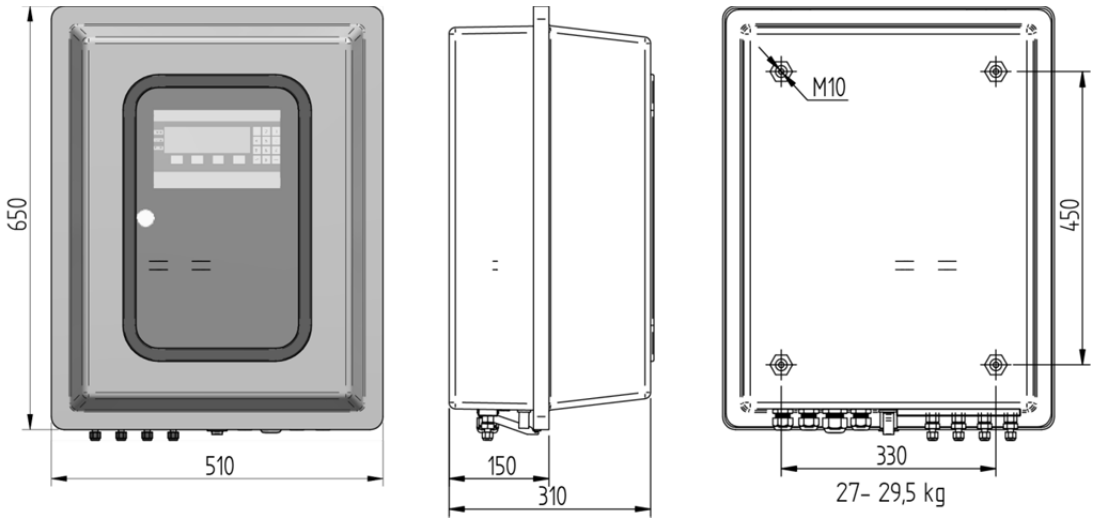


Figure 39 – GRP protective housing (optional) **-** Dimensions in mm

B.2 Probe Dimensions

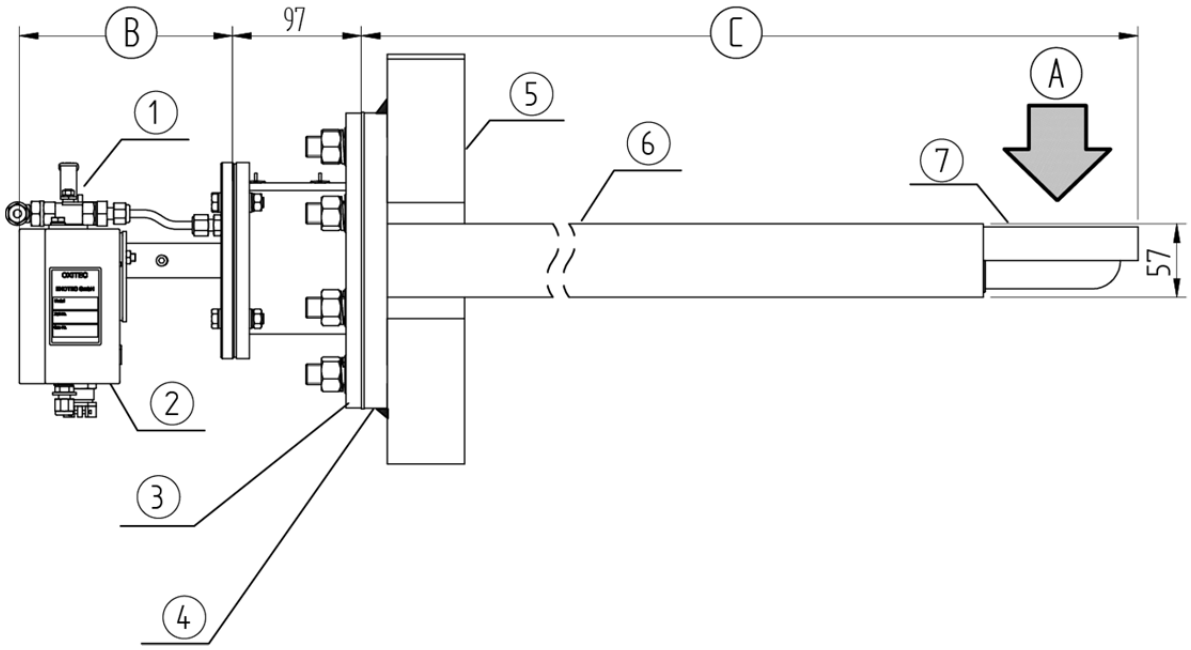


Figure 40 - Dimensions of the ZIRKOR200, probe lengths 1 – 2 (dimensions in mm)

1	Test gas valve/Solenoid valve (Optional)
2	Connection box
3	Protection tube flange
4	Counter flange (welded gas tight)
5	Duct wall
6	Protection tube
7	V-shield
A	Flue gas - max. 600°C

		Length 1	**Length 2**
B		135 mm	150 mm
C	Insertion depth	520 mm	950 mm
	Weight	11 kg	13 kg

Dimensional drawings

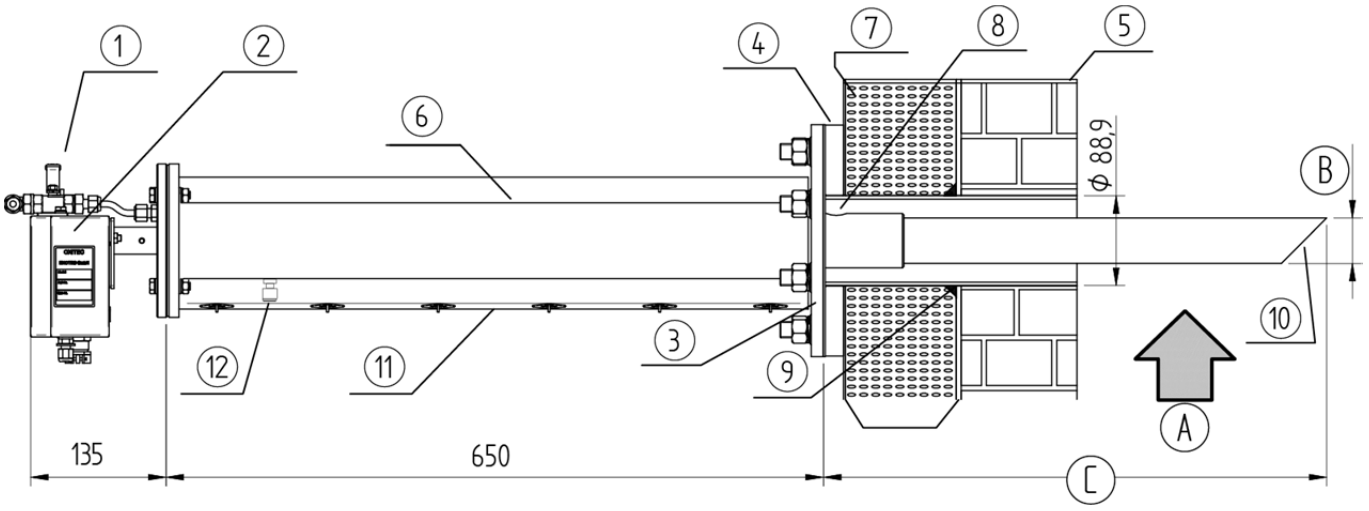


Figure 41 - Dimensions of the ZIRKOR200, probe length 1 with cooling protection tube (dimensions in mm)

1	Test gas valve/Solenoid valve (Optional)
2	Connection box
3	Protection tube flange
4	Counter flange
5	Duct wall
6	Cooling protection tube
7	Insulation
8	Gas outlet (do not block)
9	Welded gas tight
10	Gas entry
11	Insulation jacket
12	Suction connection
13	Steel cover

		PROTEC		**INCOLOY**	
A	Flue gas temp. max. *	1400 °C		1050 °C	
B	Diameter	45 mm		48 mm	
		Length 1	**Length 2**	**Length 1**	**Length 2**
C	Insertion depth	500 mm	1000 mm	500 mm	1000 mm
	Weight	19,1 kg	20,2 kg	20,0 kg	21,5 kg

* On demand up to 1600 °C (Al_2O_3)

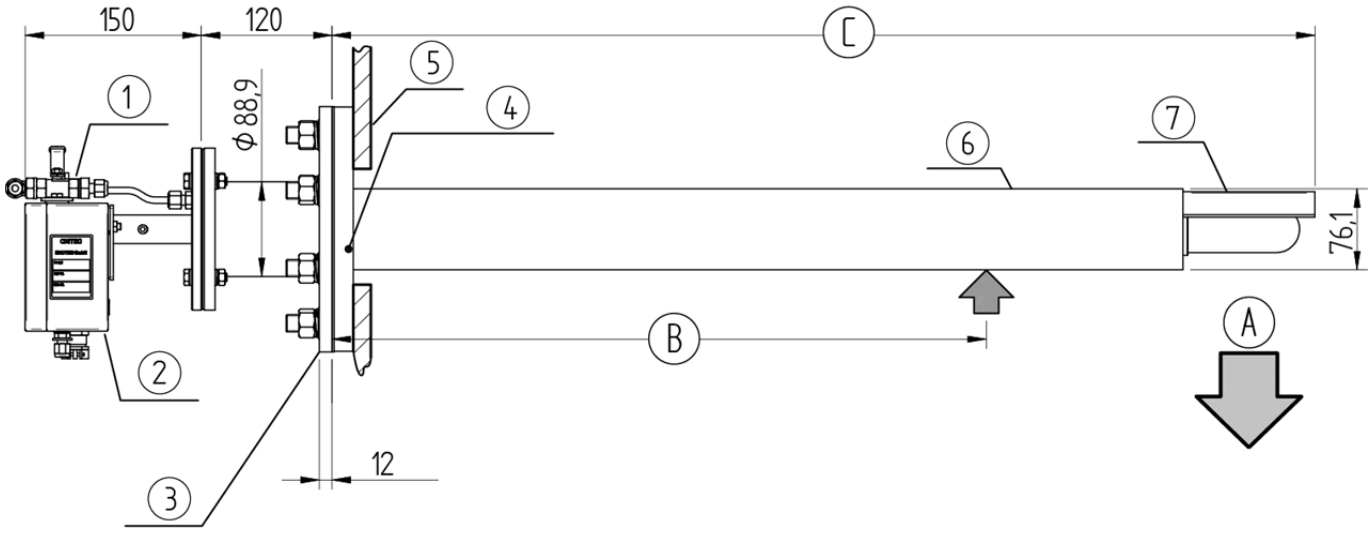


Figure 42 - Dimensions of the ZIRKOR200, probe lengths 3 - 5 (dimensions in mm)

1	Test gas valve/Solenoid valve (Optional)
2	Connection box
3	Protection tube flange
4	Counter flange (welded gas tight)
5	Duct wall
6	Protection tube
7	V-shield
A	Flue gas - max. 600°C

		Length 3	Length 4	Length 5
B	From probe length 4 and longer, an on-site support is required			
C	Insertion depth	1835 mm	2768 mm	3682 mm
	Weight	17,5	21,1 kg	25,0 kg

B.3 Counter Flange Dimensions

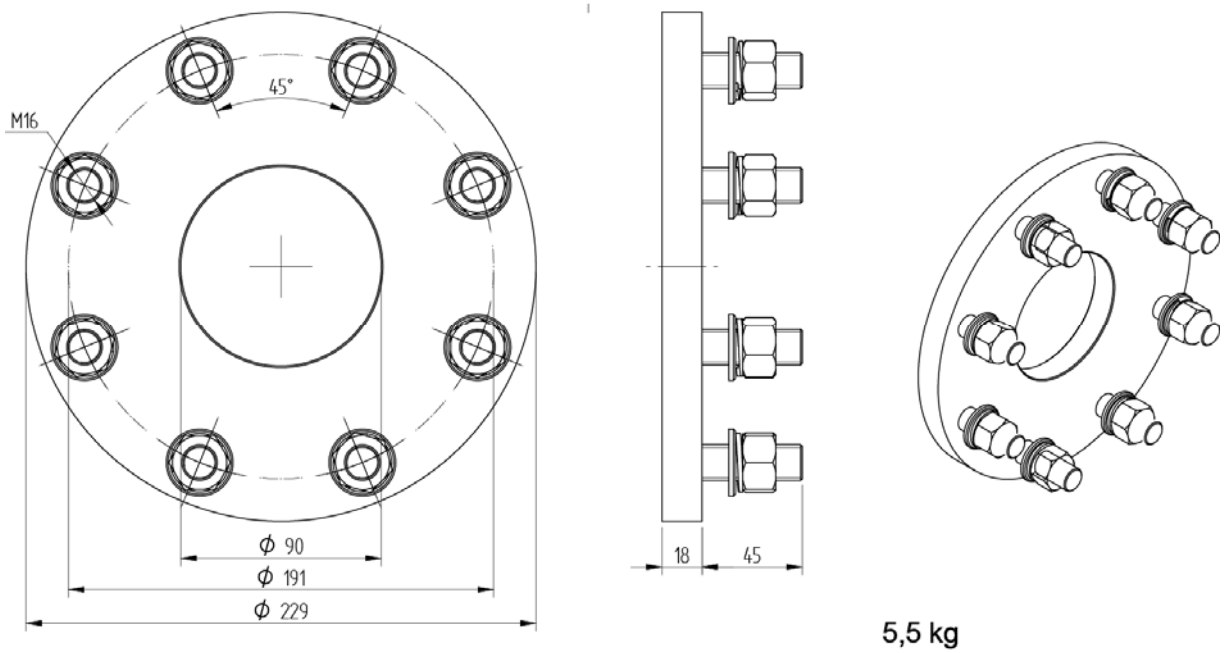


Figure 43 - Dimensions of the counter flange

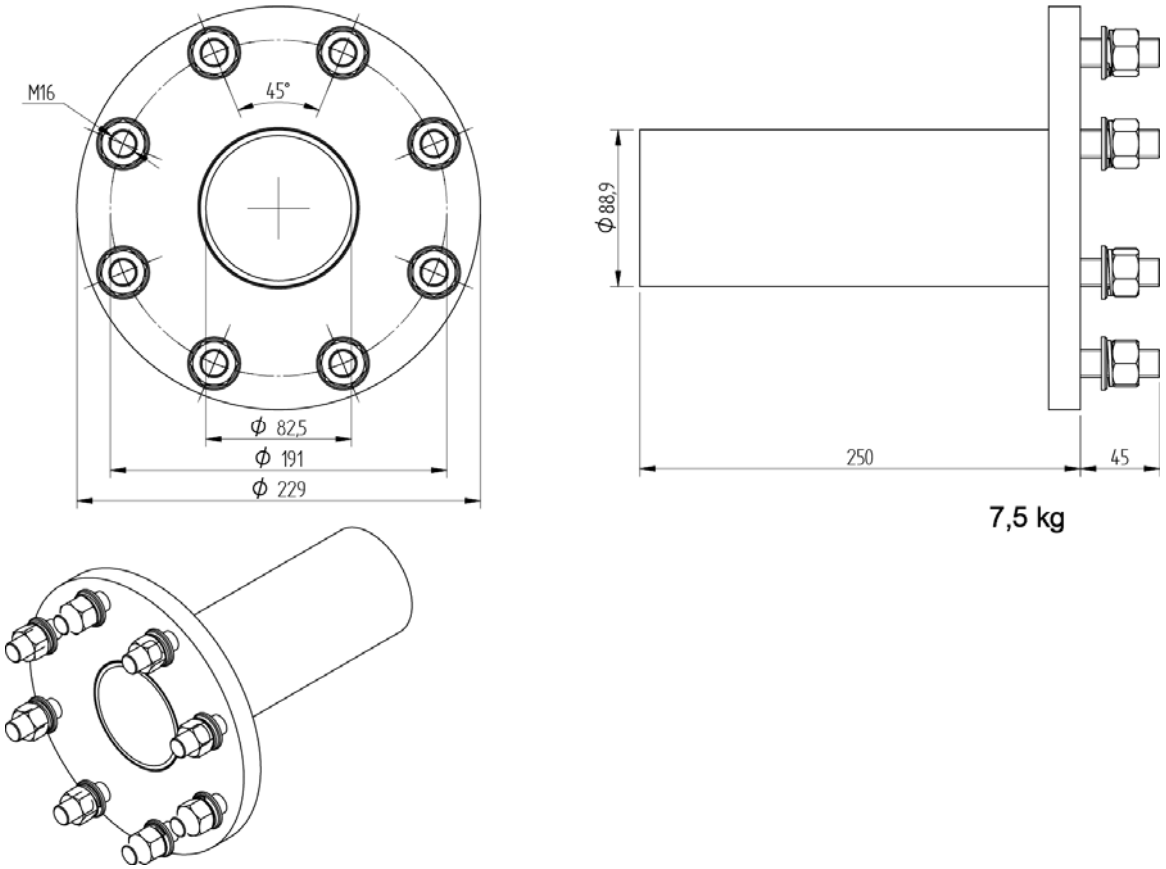
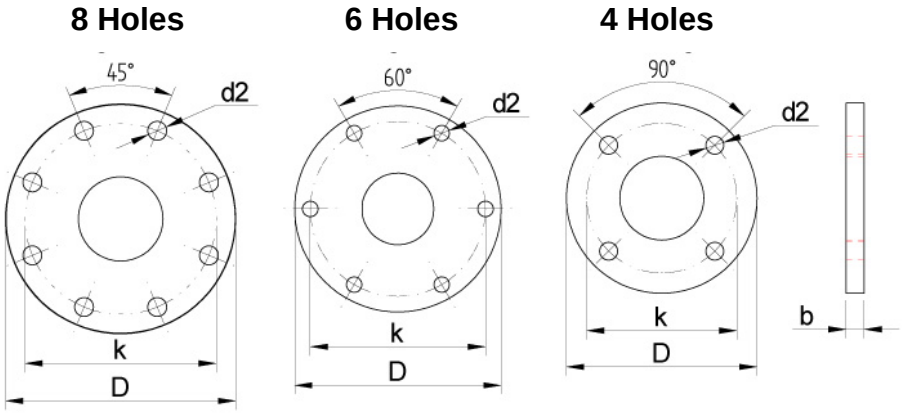


Figure 44 - Dimensions of counter flange with tube (others on request)

B.4 Dimensions of protection tube flanges



Abmessungen / Dimensions Flanschtyp / Type of flange	D	b	k	d2	Bohr. holes
ANSI 4" 150lbs FF eq Best.-Nr. /Order code:**A**	228,6 (9,00)	12,5 (0,50)	190,5 (7,50)	19,0 (0,75)	8
DIN2527 DN65/PN16 Best.-Nr. /Order code:**B**	185,0 (7,28)	18,0 (0,71)	145,0 (5,71)	18,0 (0,71)	4
DIN2527 DN65/PN6 Best.-Nr. /Order code:**C**	160,0 (6,27)	14,0 (0,55)	130,0 (5,12)	14,0 (0,55)	4
ANSI 2" 150lbs FF eq Best.-Nr. /Order code:**D**	153,0 (6,00)	12,5 (0,50)	121,0 (4,75)	20,0 (0,78)	4
DIN2527 DN50/PN16 Best.-Nr. /Order code:**E**	165,0 (6,47)	18,0 (0,71)	125,0 (4,90)	18,0 (0,71)	4
ANSI 3" 300lbs Best.-Nr. /Order code:**F**	209,5 (8,25)	28,6 (1,13)	168,3 (6,63)	22,2 (0,87)	8
ZFG2 probes eq. Best.-Nr. /Order code:**G**	165,0 (6,47)	12,0 (0,47)	140,0 (5,49)	12,5 (0,50)	6
DIN2527 DN80/PN16 Best.-Nr. /Order code:**H**	200,0 (7,87)	20,0 (0,79)	160,0 (6,29)	18,0 (0,71)	8
Mod. 132 eq. Best.-Nr. /Order code:**I**	127,0 (4,98)	8,0 (0,31)	99,0 (3,88)	9,0 (0,35)	4
ANSI 3" 150lbs Best.-Nr. /Order code:**J**	190,5 (7,50)	23,9 (0,94)	152,4 (6,00)	19,1 (0,75)	4
DIN2527 DN100/PN2 Best.-Nr. /Order code:**K**	235,0 (9,25)	24,0 (0,95)	190,0 (7,48)	22,0 (0,86)	8
Servomex 700 eq Best.-Nr. /Order code:**N**	155,0 (6,10)		120,6 (4,75)	11,0 (0,43)	8
Servomex 790M eq Best.-Nr. /Order code:**P**	220,0 (8,66)		186,0 (7,32)	11,0 (0,43)	4
DIN2527 DN100/PN1 Best.-Nr. /Order code:**R**	220,0 (8,66)	20,0 (0,79)	180,0 (7,09)	18,0 (0,71)	8
ANSI 4" 150lbs RF Best.-Nr. /Order code:**T**	228,6 (9,00)	23,9 (0,94)	190,5 (7,50)	19,1 (0,75)	8
Kundenspez./Customer spec. Best.-Nr. /Order code:**X**					

Figure 45 - Dimensions of protection tube flanges

Protection tube flange
Mat.: DIN 1.4571 / AISI 316 Ti
Dimensions: see table
Outside diameter protection tube:
57mm/76,1mm

Data subject to change without notice.

C Spare Parts

C.1 Probe Components Probe lengths 1 - 2

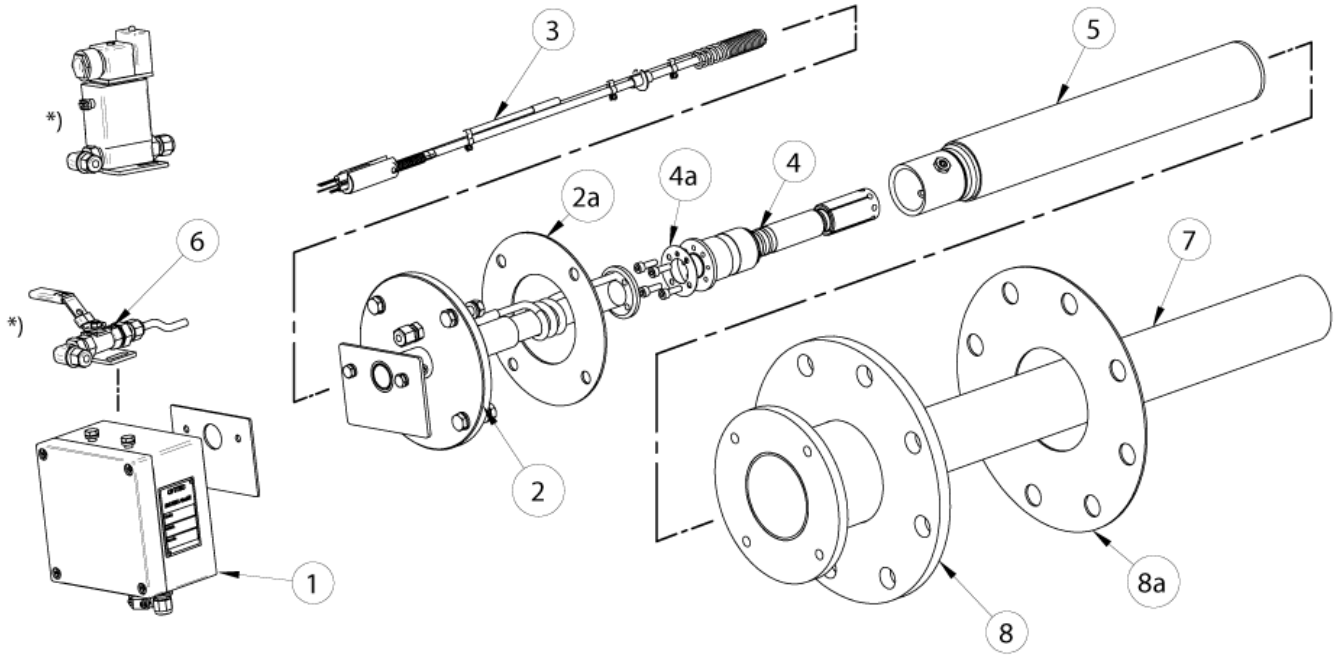


Figure 46 - Probe Components Probe lengths 1 - 2

No.	Part	Part No.
1	Connection Box	2089298
2	Measuring probe tube	Length 1 - 2089308 Length 2 - 2089309
2a	Probe flange gasket	2089294
3	Probe inner part	Length 1 - 2089270 Length 2 - 2089271
4	Oxygen measuring cell	2089289
4a	Measuring cell gasket	2089295
5	Filter head	Ceramic filter 2089344 Ceramic filter for vertical installation 2089362 Basalt filter 2089363 Basalt filter 2089364 Sintered metal filter 2089365 Sintered metal filter with flame arrestor 2089366 Sintered metal filter for vertical installation 2089368
6	*)Test gas valve / *) Solenoid valve	Please inquire at SICK.
7	Protection Tube	Please inquire at SICK.
8	Protection tube flange	Please inquire at SICK.
8a	Protection tube flange gasket(“A”)	2089296

C.2 Probe Components Probe lengths 3 - 5

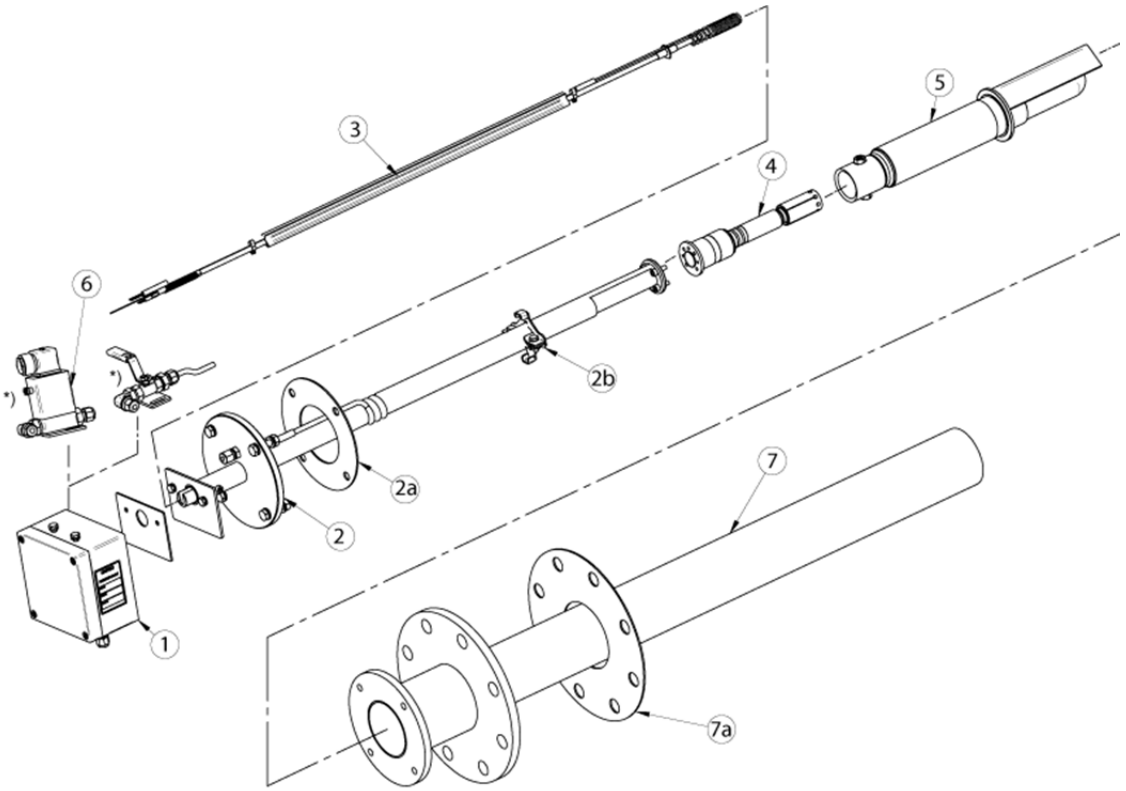
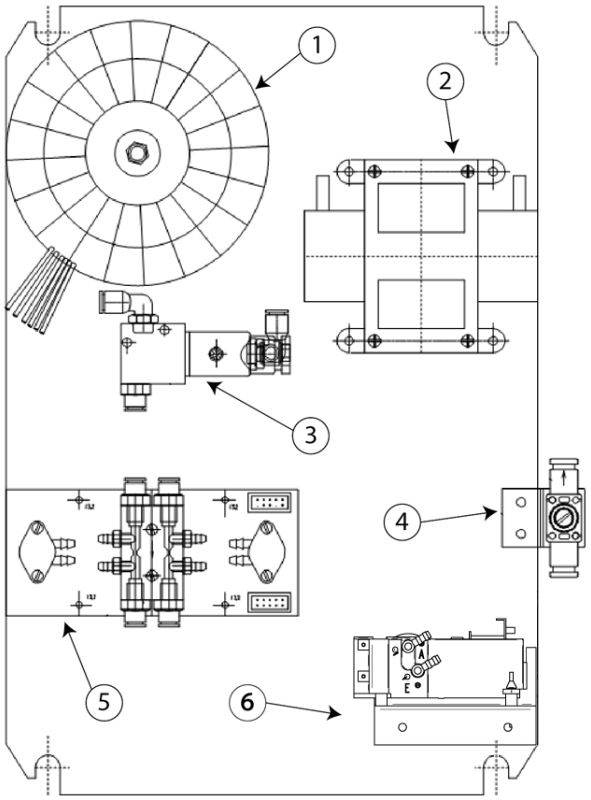


Figure 47 - Probe Components Probe lengths 3 - 5

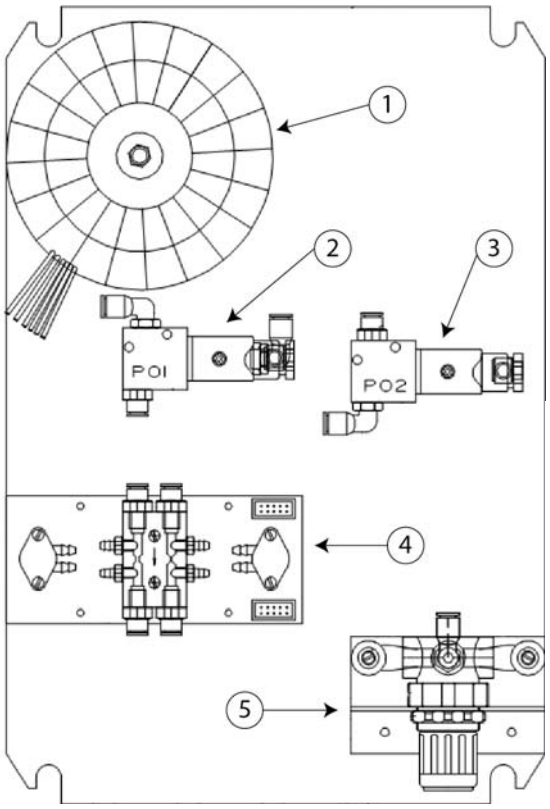
No.	Part	Part No.
1	Connection Box	2089298
2	Measuring probe tube	Length 3 - 2089311 Length 4 - 2089312 Length 5 - 2089313
2a	Probe flange gasket	2089294
3	Probe inner part	Length 3 - 2089272 Length 4 - 2089274 Length 5 - 2089273
4	Oxygen measuring cell	2089289
4a	Measuring cell gasket	2089295
5	Filter head	Ceramic filter 2089337 Ceramic filter vertical installation 2089338 Basalt filter 2089339 Basalt filter for vertical installation 2089340 Sintered metal filter 2089341 Sintered metal filter with flame arrestor 2089342 Sintered metal filter for vertical installation 2089343
6	*)Test gas valve / *) Solenoid valve	Please inquire at SICK.
7	Protection Tube	Please inquire at SICK.
7a	Protection tube flange gasket	2089296

C.3 Mounting Plates of the Electronic Unit



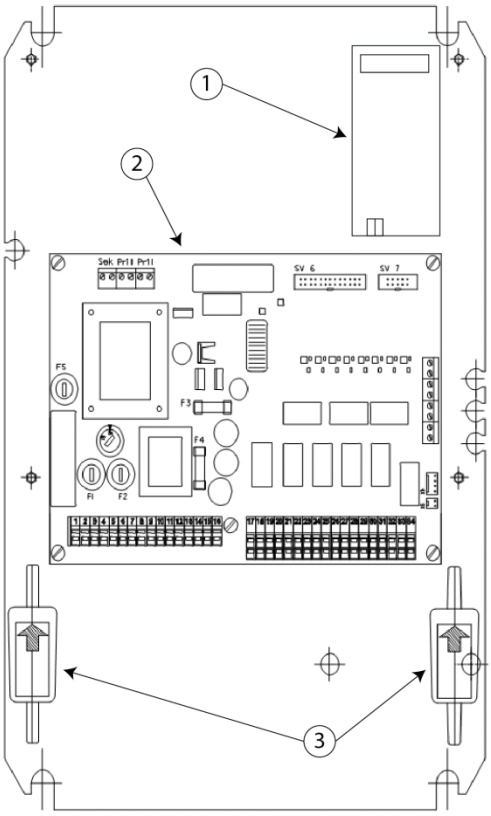
Parts List Test gas and reference air unit with internal pumps		
1	2089317	Transformer prim. 2*115V, sec. 115V
2	2089330	Test air pump 720 l/h
3	2089324	Test gas solenoid valve P01 - with pneumatic unit and fittings
4		Restrictor one way
5	2089327	Internal flow meter for reference air and test gas
6	2089329	Reference air pump 30l/h

Figure 48 - Mounting plate 1 (version with pumps)



Parts List Test gas and reference air unit for instrument air		
1	2089317	Transformer primary 2*115V, sec. 115V
2	2089324	Test gas solenoid valve P01 - with pneumatic unit and fittings
3	2089325	Test gas solenoid valve P02 - with instrument air unit and fittings
4	2089327	Internal flow meter
5	2089336	Pressure regulator

Figure 49 - Mounting plate 1 (version with instrument air)



Parts List Mounting plate 2		
1	2089318	Optional mA-output board.
2	2089319	power board
3	2089328	Filter for reference air and test air - for version with internal pumps

Figure 50 - Mounting plate 2

C.4 Display Board

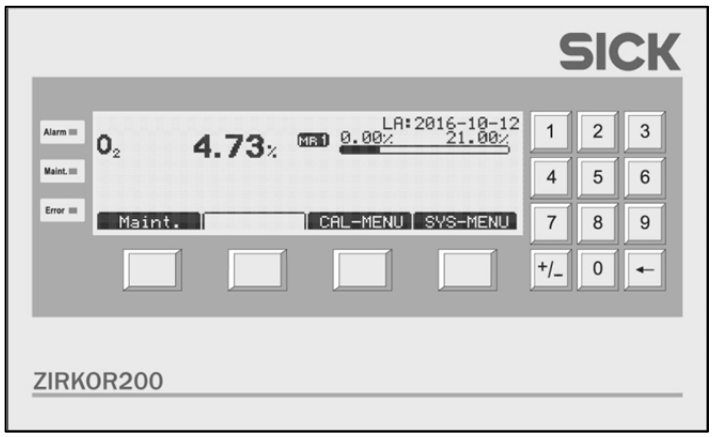


Figure 51 - Display board

Parts List Display Board	
2089320	Display board without pneumatic
2089321	Display board with pneumatic

Index

A

Access to the Terminals 10
Adjusting the Flow Rate 31
Adjusting the V-shield 14

C

Calibration 27
Commissioning the System 19
Cooling Protection Tube 14
Counter Flange 13

D

Dimensional drawings 44
Dimensions
- Adapter Plate Dimensions 48
- Dimensions of protection tube flanges 49
- Electronic Unit Housing 44

Display Board 53
Disruption of the Process 6

E

Electrical Connections of the Probe 15
Exchange fuses 30
Exchange of Probe Inner Parts 35

F

Ferrite Sleeves 10

I

Installation
- Electronic Unit 8
- Probe signal cable 9

Installation of the probe 13

L

Language settings 26

M

Maintenance Intervals 37
Mounting Plates of the Electronic Unit 52

N

Name Plate 7
Name Plates 7

P

Pneumatic Connections
- Probe 17

Position of the adjustment valves 32
Pressure and Flow rates 31
probe tube 34

R

Relay outputs 36
Replacing the O_2 Sensor 33
Replacing the probe 33
Requirements for the Gas Supply 43

S

Service and Maintenance 30
Spare Parts 50
Status Messages
- Alarm Messages 39
- Error Messages 38
- Service Messages 39

System Overview 4

T

Technical Specifications 41
Troubleshooting 40

W

Wiring Diagram of the Electronic Unit 11

Z

ZIRKOR200 Wiring diagram 12

Australia
Phone +61 3 9457 0600
1800 334 802 - toll free
E-Mail sales@sick.com.au

Austria
Phone +43 22 36 62 28 8-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail marketing@sick.com.br

Canada
Phone +1 905 771 14 44
E-Mail information@sick.com

Czech Republic
Phone +420 2 57 91 18 50
E-Mail sick@sick.cz

Chile
Phone +56 2 2274 7430
E-Mail info@schadler.com

China
Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-2515 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany
Phone +49 211 5301-301
E-Mail info@sick.de

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail office@sick.hu

India
Phone +91 22 4033 8333
E-Mail info@sick-india.com

Israel
Phone +972 4 6881000
E-Mail info@sick-sensors.com

Italy
Phone +39 02 274341
E-Mail info@sick.it

Japan
Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +6 03 8080 7425
E-Mail enquiry.my@sick.com

Mexico
Phone +52 472 748 9451

Netherlands
Phone +31 30 2044 000
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 - toll-free
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania
Phone +40 356 171 120
E-Mail office@sick.ro

Russia
Phone +7 495 775 05 30
E-Mail info@sick.ru

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 591 788 49
E-Mail office@sick.si

South Africa
Phone +27 11 472 3733
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321
E-Mail info@sickkorea.net

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886 2 2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2645 0009

Turkey
Phone +90 216 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 4 88 65 878
E-Mail info@sick.ae

United Kingdom
Phone +44 1727 831121
E-Mail info@sick.co.uk

USA
Phone +1 800 325 7425
E-Mail info@sick.com

Vietnam
Phone +84 945452999

Further locations at **www.sick.com**

8020278

SICK
Sensor Intelligence.